Metals Review

THE NEWS DIGEST MAGAZINE

Volume XXI, No. 10 | FEATURING: FERROUS METALS | October 1948

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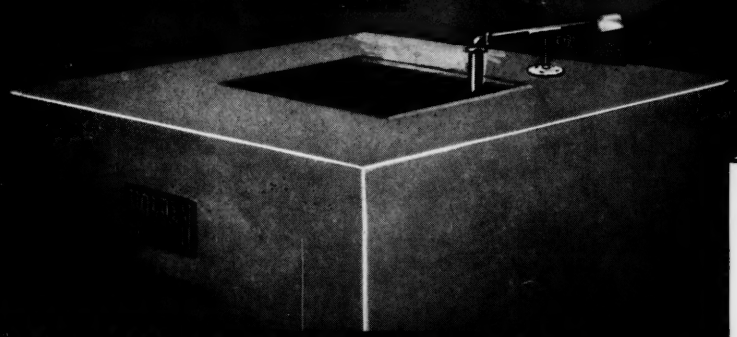

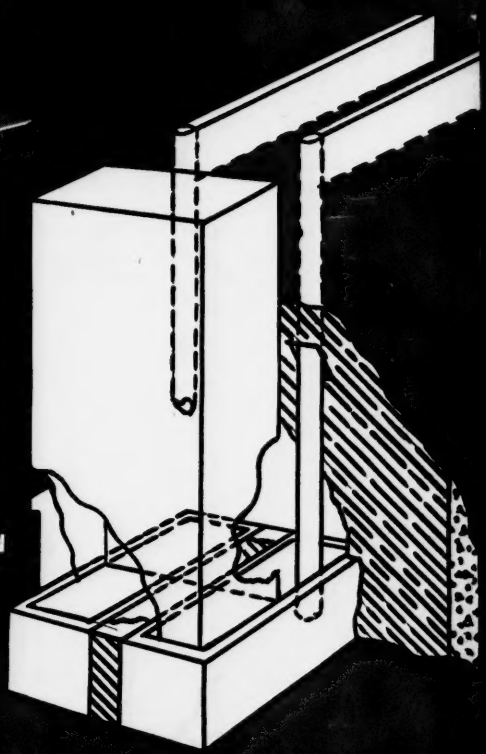

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INTRODUCTORY PHYSICAL METALLURGY

by **CLYDE MASON**
Professor of Metallography, School of Chemical and Metallurgical Engineering, Cornell University

This interesting book on physical metallurgy is based on a series of lectures presented during the 1947 National Metal Congress and Exposition. Prof. Mason points out that within the present generation scientific knowledge of metals has grown enough so that we can begin to understand what goes on inside them, and why they behave as they do. This is the field of physical metallurgy.

It is up to the worker with metals to follow what's new as well as to understand what's old, and this book helps the reader to do just that. General principles and behavior that are common to many metals are summarized. Knowledge of the alloys of one metal frequently applies to those of another, and as Prof. Mason says, "it won't hurt any 'brass' man to learn a little about alloys that aren't yellow, particularly since metals are so often in competition with each other."

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Ferrous Metals Manufacture & Properties

Highlights of Noteworthy Articles Published During the Past 12 Months

By S. L. Case
Battelle Memorial Institute

APPROXIMATELY 85 million tons of steel was produced in the United States in 1947, and the tonnage produced in 1948 will probably exceed this figure. Steel producers are expanding and improving their manufacturing facilities. About 496 million dollars was spent in 1947 and an estimated 565 million dollars will be spent in 1948. This program will increase the present ingot-making capacity by 2.5 million tons, raising it from 91 million to 93.5 million tons.

The apparently insatiable demand for more and more steel has been reflected in many of the articles that have appeared in technical periodicals during the past year.

More than 700 such papers dealing with production and properties of ferrous materials were abstracted in the A.S.M. Review of Current Metal Literature during this period. The present article gives the highlights of the most important of these.

Blast-Furnace Practice

Of considerable current interest is the operation of blast furnaces under high top pressure. B. S. Old and coworkers (2b-114, July 1948)* describe the operation of two blast furnaces of Republic Steel Corp. under a top pressure of 10 psi. The two furnaces show a substantial increase in efficiency over the usual low-pressure operation. The increase in top pressure was accomplished by increasing the flowing pressure and throttling the exhaust gases. Velocity of gas through the furnace is thus decreased, and the furnace can be blown at a substantially higher wind rate. With such blowing practice, iron production was increased 11 to 20%, coke consumption reduced approximately 13% and flue dust decreased 30%. The net saving in manufacturing cost was over $1 per ton of iron.

The theory underlying this experiment is based on the fact that an increase in average static pressure of the stack increases the density of the gases passing through the furnace. More wind can thus be blown and more iron produced without increasing the linear gas velocity through the furnace to a point where hanging, slipping, channeling, and dusting make furnace operation impractical and uneconomical.

Increasing the static pressure in a blast furnace allows the operator a greater choice in blowing:

1. He can blow the furnace at a substantially higher wind rate (pounds of air per minute) and maintain the same gas velocity through the furnace.
2. He can maintain the same wind rate with a marked decrease in gas velocity.
3. He can blow the furnace at an intermediate rate, obtaining a material increase in wind rate while maintaining a decreased gas velocity through the furnace.

Operation of a blast furnace at an increased average furnace pressure (the sum of blast pressure plus top pressure divided by two) brings about a number of changes which affect the coke rate. The physical changes influencing the coke consumption per ton of iron have to do principally with improved gas-solid contact in the stock column. The chemical changes are based on longer reaction time because of lower gas velocities. This results in greater reduction efficiency and a decrease in the CO:CO_2 ratio of blast-furnace gas. The multiple effect of these changes explains the apparently contradictory observation that coke rate can decrease despite an increase in wind blown.

In one of the furnaces operated at normal pressure (1.2 psi. top pressure and 18 psi. blast pressure), the average wind volume was 67,500 cu. ft. per min.; at high static pressure (10 psi. top pressure and 28 psi. blast pressure), the wind volume increased to 80,000 cu. ft. per min. The average coke rate was 1705 lb. per ton of iron under normal operation and 1482 lb. per ton under high top pressure. Production was 959 and 1184 tons of iron per day, respectively.

The lower CO:CO_2 ratio in the blast-furnace gas under high top pressure lowers, of course, its calorific value. However, the decrease was not significant enough to interfere seriously with the utilization of the gas. The average heating value of blast-furnace gas under normal furnace operation was 90 B.t.u. At high top-pressure operation, the calorific value of the gas was 86.5 B.t.u. per cu. ft.

Conversion of a blast-furnace operation requires a number of changes in the auxiliary equipment. As a rule, most blast-furnace plants have extra blower capacity during normal operations; however, since maximum iron tonnages under high top pressure will require a considerable increase in wind, a greater blowing capacity is essential. This is by far the most expensive item in the general changeover to high-pressure operation. It is believed, however, that the increase in blowing capacity, while high in cost, will pay for itself within two years through increased iron output.

The top gas under high top pressure conditions represents a potential source of power which might be used to operate a booster blower furnishing the additional wind and pressure. Although the available pressure head is small, the large volume represents a considerable source of energy, amounting to about 2800 hp. when blowing 85,000 cu. ft. per min.

The other changes necessary for conversion are relatively minor. Because of the high top pressure, it would be impossible to lower the large bell to charge materials into the furnace unless means were provided to counteract the added upward force. The adding of counterweights to the bell's understructure would be impractical, because of the immense weight. However, if pressure inside the large hopper is made approximately equal to furnace top pressure when the furnace is being charged, the large bell could be lowered without major alterations in the existing operating equipment. A pressure equalizer is, therefore, an essential change, and Mr. Old (2b-114, July 1948) describes in detail the necessary mechanism.

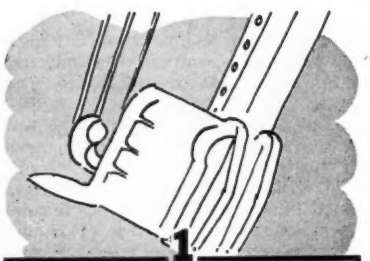
Excessive erosion of bleeder valves with increased top pressure also poses a serious problem. Installation of a clean gas bleeder was found to ameliorate this condition. When the furnace slips, pressure is relieved by the clean gas bleeder through switch relays. The dirty gas bleeders will be opened only in rare cases of very high slip pressures of explosive violence.

(Turn to page 5)

*Literature references are cited by the corresponding item number in the *Review of Current Metal Literature* instead of repeating entire title, author, and source; this information can be obtained by referring to *Metals Review* for the month indicated.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month



ORE BENEFICIATION

1a—General

1a-27. The Application of Small Amplitude High Frequency Vibratory Motion to Certain Types of Ore Dressing Equipment. P. T. Bruhl, E. R. Rudolph, and L. Taverner. *Journal of the Chemical, Metallurgical and Mining Society of South Africa,* v. 48, May 1948, p. 343-360; discussion, p. 360-363.

Applied to machinery such as concentrating tables, strakes, jigs, and classifiers.

1a-28. Radioactive Tracers in Flotation. A. M. Gaudin, P. L. de Bruyn, F. W. Bloecher, and C. S. Chang. *Mining and Metallurgy,* v. 29, Aug. 1948, p. 432-435.

Presents a study of the use of carbon 14 as a tracer and the reasons why it is suited to the study of flotation reactions. Theory and operation of counter tubes and typical problems in which tracer technique will be useful. 11 ref.

1a-29. Laboratory Concentration of Complex Sulfide-Oxide Ore From Shenandoah-Dives Mine, Silverton, Colo. Heine Kenworthy. *Mines Magazine,* v. 38, Aug. 1948, p. 19-24, 40.

A résume of ore-dressing treatment, with tables of resultant data.

1a-30. Automatic Control of Pulverizers. Phelan McShane. *Engineering and Mining Journal,* v. 149, Sept. 1948, p. 86-87.

By automatically adjusting feed rate to suit particle size and hardness, device increases tons crushed or ground by ordinary ball-mill or crusher equipment.

1c—Nonferrous

1c-57. Diamond Drilling at the Tallapoosa Copper Mine, Haralson County, Ga. T. J. Ballard and F. K. McIntosh. *Bureau of Mines, Report of Investigations* No. 4316, July 1948, 8 pages.

Results of sampling and analysis.

1c-58. Concentration of Oxidized Lead and Copper Ores. Clarence Thom. *Deco Trefoil,* v. 12, July-Aug. 1948, p. 5-8.

Methods and laboratory test results.

1c-59. Investigation of Round Mountain Manganese Properties, Bland County, Va. M. H. Kline and A. F. Robertson. *Bureau of Mines, Report of Investigations* No. 4342, July 1948, 9 pages.

Gravity concentration and flotation tests. Flowsheet for manganese ore.

1c-60. Solubilité des principaux acides fixes des minerais d'uranium dans l'éther éthylique et coefficient de partage entre l'eau et l'éther éthylique. (Solubility of the Principal Fixed Acids of Uranium Minerals in Ethyl Ether and Partition Coefficient Between Water and Ethyl Ether.) M. Bachelet, E. Cheylan, and J. Le Bris. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 44, Nov.-Dec. 1947, p. 302-305.

Results of investigation permit evaluation of the extent of purification of uranyl nitrate by ether extraction.

1c-61. Minerals for Chemical and Allied Industries. A Review of Sources, Uses and Specifications. Part XXIII. Sydney J. Johnstone. *Industrial Chemist and Chemical Manufacturer,* v. 24, Aug. 1948, p. 509-514.

Deals with tantalum and columbium. (To be continued.)

1c-62. North Carolina Tungsten. Frank H. Bishop. *Mining Congress Journal,* v. 34, Sept. 1948, p. 77-82.

Mining, milling, and concentration procedures. Flowsheet.

For additional annotations indexed in other sections, see: 10a-72; 25b-18.

SMELTING, REDUCTION and REFINING

2a—General

2a-12. Cathodes With Low Potentials for Decreasing the Evolution of Hydrogen. (In Russian.) N. P. Fedot'ev, N. V. Berezina, and E. G. Kruglova. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 21, April 1948, p. 317-328.

Evolution of hydrogen causes difficulty during various electrochemical processes. 15 types of low-carbon and alloy steels were evaluated in an attempt to decrease this phenomenon, but the results were not encouraging. However, it was found that special surface treaments, such as sandblasting, or electroplating with certain nickel alloys, gave good results.

2b—Ferrous

2b-148. Electrolytic Manganese in Open-Hearth and Bessemer Steel Tests at Jones & Laughlin Steel Corp., Pittsburgh, Pa. Frederick Sillers, Jr. *Bureau of Mines, Report of Investigations* No. 4303, July 1948, 33 pages.

Results of tests on application of electrolytic manganese to S.A.E. 1035 steels made in experimental openhearth furnace; the manufacture of laboratory and mill heats of low-carbon rimming strip steel; the manufacture of full-scale production heats of low-carbon (0.03-0.05% C) killed steels, and the manufacture of two grades of bessemer screw steel, A.I.S.I. B-1112 and A.I.S.I. B-1113.

2b-149. Production of Sponge Iron: Gaseous Reduction of Iron Oxide Glomerules in a Shaft Furnace. Edward P. Barrett and Carl E. Wood. *Bureau of Mines, Report of Investigations* No. 4305, July 1948, 19 pages.

Shaft-furnace process and its possible use in connection with experimental plant for the gasification of lignite. Procedure for making tests with the loss-in-weight apparatus.

2b-150. Oxygen Enriched Air for Steel Production. *Engineer,* v. 186, July 30, 1948, p. 103-105.

Theory, refractory linings, effect on output, quality of product, effect on refractories, fuel, raw material and other economic factors.

2b-151. Steel Casting-Pit Practice and Ingot Defects. R. N. Duncan. *Engineering,* v. 166, July 30, 1948, p. 117-118.

Practical discussion. Ladle, ingot mold, teeming speed and teeming, and stripping. Suggestions for reducing moisture and other causes for defects.

2b-152. Open Hearth Furnace Models. A. R. Philip. *Nature,* v. 162, July 31, 1948, p. 188.

Refers to a description of the use of aluminum powder for flow visualization in a water model of an openhearth furnace (March 27 issue). It was since found that part of the pattern was caused by air bubbles. Introduction of a stream of gas into the water ahead of the checkers resulted in immediate improvement.

2b-153. New Methods of Ladle Desulphurising Pig Iron. W. C. Newell, A. J. Langner, J. W. Parsons. *Foundry Trade Journal,* v. 85, Aug. 19, 1948, p. 165-169; discussion, p. 170-172.

Interim report prepared by the Steel Castings Division of the British Iron & Steel Research Association for its Melting Sub-Committee upon its recent theoretical and practical investigation of new and im-

(Turn to page 6)

Exclusive of blowing equipment, the mechanical alterations necessary for conversion of a blast furnace to high top-pressure operation are estimated at about $125,000. In new construction, the cost differential is inconsequential.

Steelmaking

The subject of deoxidation has received its usual share of attention during the past year, but few if any original data were presented. Of some interest was a paper by Loria and Thompson (2-188, Sept. 1947) on ladle deoxidation of killed steel with silicon carbide. Silicon carbide is soluble in steel and dissociates readily. The free energy of the reaction

$SiC + 3\ FeO \rightarrow SiO_2 + CO + 3\ Fe$

is of the order of 80,000 cal. at steelmaking temperature. Consequently silicon carbide is very effective in removing oxygen from solution in molten steel.

In their experimental work, Loria and Thompson made ladle additions of silicon carbide (ranging from 1.1 to 2.2 lb. per ton) to a low-carbon steel. Granular silicon carbide of about 50-mesh, contained in a four-ply paper bag, was thrown into the tapping stream when the ladle was one-fourth full. The authors claim that the surface condition of billets was appreciably improved by ladle deoxidation with silicon carbide as compared to aluminum or calcium carbide. A steel producer who used this practice over a period of six months on a series of nickel-chromium and nickel-molybdenum steels reported a mill yield of 95.2%, compared with 92.6% for previous practice.

Judging from the metallographic data presented in this paper, deoxidation with silicon carbide also had a favorable effect on the cleanness of the steel; inclusions were fewer and they were randomly distributed. Silicon carbide apparently had a minor effect, if any, on grain size of the treated steel. The physical properties of the steel did not appear to be perceptibly affected, one way or another.

Casting of Ingots

Effect of vibration during solidification on the structure of ingots has been a controversial subject for many years. Geigel (2b-82, June 1948) recommends the use of a mold-shaker device in casting medium-carbon rimmed steel. The mechanism is mounted in concrete on a separate foundation under the narrow-gage track of the pouring floor. The track is bolted to an I-beam which rests on the jarring mechanism. A double cam device operated by a 50-hp. motor raises the entire floor (I-beam and track) about 4 in. and lets it drop sharply. A rheostat permits the steel pourer to adjust the frequency of the jolts within a range of 24 to 50 per minute. A frequency higher than 50 was found to cause excessive splashing.

The pouring floor holds 16 narrow-gage ingot cars, and has four independent shaker devices. The total weight that the shaking device supports is 110 tons; 16 slab molds or 32 square molds can be shaken at the same time. When the ingot has solidified about 75% of the cross section the shaker is stopped, the ingots are capped with iron caps, and a water spray is applied to complete the solidification and avoid rising in the center of the ingot. Except for steels containing more than 0.30% carbon, small mold additions of aluminum were found necessary to rim the steel with a slight settling of about 1 in.

Some ingots from a heat of 0.20 to 0.25% carbon steel were allowed to rim without disturbance, while other ingots from the same heat were jolted. The ingots that were rimmed in the regular manner had a very sluggish mold action; they rose about 7 in. and were thin skinned (about 0.5 in. thick at the bottom of the ingot). The jolted ingots rimmed flat and the skin was about 3 in. thick at the bottom.

Similar tests were made on a heat of low-carbon steel (0.07% C, 0.36 to 0.37% Mn, 0.031% S, and 0.008% P). One ingot of each type was split and examined. There was no apparent difference in the extent of segregation, but the regular ingot had many primary blowholes near the surface, while the jolted ingot had very few. Because of greater soundness, the blooming-mill yield of jolted ingots averaged 2% higher than that of normal rimmed ingots.

Dealing with the kinetics of solidification of killed steel ingots, Spretnak (2-186, Sept. 1947) studied the factors in solidification that govern the type of primary ingot structure. He employed the electrical analogy method supported by actual bleeding tests on 6x6-in. and 20x23-in. ingots.

The electrical analogy method does not require actual experimentation with the heat-transfer system under consideration, but depends upon building up an electrical circuit which represents the geometry and imitates electrically the thermal properties and behavior of the bodies involved.

In plotting the electrical analogy data, a point at a particular distance from the mold wall is considered to be frozen when the steel at that point reaches the liquidus temperature for the steel composition. This method of plotting was in satisfactory agreement with plots based on actual bleeding tests.

To determine the effect of varying degrees of superheat on the depth frozen at a constant time interval after pouring, five heats of S.A.E. 4340 steel were cast in 6x6-in. hot-topped ingots at temperatures ranging from 2820 to 3020° F. Temperatures were read with an optical pyrometer, the pouring time averaged 30 sec., and the molds were maintained at a constant temperature of 200° F. The ingots were bled at varying time intervals after pouring, and the shell of frozen metal was measured on the side that was up as the ingot was tipped, since there was a possibility of the shell thickness increasing on the other faces as the molten metal moved over them during the bleeding. This work was later extended to larger ingots.

On the basis of data obtained in these experiments, a general expression was formulated for transverse solidification of ingots as a function of superheat:

$$D_c = 0.84 \sqrt{0.00071\ D_i^{1.695}\ T_s}$$

where:

D_c = depth of columnar zone in meters

D_i = cross-sectional dimensions of ingot in inches

T_s = °F superheat.

The width of the range between the liquidus and solidus was studied on several other steel compositions cast in 6x6-in. ingots. Bleeding tests indicated that the solidification curve consists of two intersecting parabolas. The intersection of these parabolas corresponds to the end of columnar crystallization and the beginning of equiaxed crystallization. As the degree of superheat was increased, the duration of columnar crystallization was lengthened, but the freezing of the equiaxed zone was accelerated, so that the over-all time for complete solidification was substantially constant and was independent of the degree of superheat. Spretnak's experiments also demonstrated that the height of the bottom cone in the ingot can be considerably reduced by insulating the bottom of the mold. Limited evidence also indicates that basic openhearth steel ingots solidify to about twice the depth of columnar crystals of basic electric steel ingots having equivalent composition and cast at comparable liquid steel temperatures.

Metallurgy of Cold Reduced Sheets

The continuously expanding use of deep drawing steel focuses attention on the metallurgical advances in the manufacture of cold reduced sheets. Some of the phases of control and production that have not previously appeared in the literature are reviewed by Altenburger (19b-26, April 1948). He emphasizes strongly the unfavorable effect of sulphur segre-

(*Turn to page 7*)

proved methods of desulphurizing remelted iron. Factors examined include slag basicity, various chemically reducing conditions, agitation by gas bubbling, and addition of specific sulphur retaining elements such as barium.

2b-154. The Application of Oxygen Enrichment to Side-Blown Converter Practice. J. L. Harrison, W. C. Newell, and A. Hartley. *Foundry Trade Journal,* v. 85, Aug. 19, 1948, p. 173-175. A condensation.

Results of several months' continuous operations with oxygen-enriched heats, which indicate that even a moderate degree of oxygen enrichment, applied with little or no modification to existing converter units, can lead to an improvemen in steelmaking practice. A series of technical advantages.

2b-155. New Process Promises Cheaper Steel. *Engineering News-Record,* v. 141, Aug. 26, 1948, p. 1.

Application of continuous casting to steelmaking as a short-cut procedure for obtaining semi-finished shapes.

2b-156. Oxygen in Side-Blown Converters. Max E. Davies. *Iron Age,* v. 162, Sept. 2, 1948, p. 87-91.

Use of oxygen in the side-blown converter by a British firm which has incorporated the technique as a production measure in its steelmaking practice. Results obtained on some 200 casts, utilizing 30 to 40% oxygen-enriched blast; effects on production rate, steel quality and refractory life. Cost data.

2b-157. Sulla possibilita di esistenza dello strato emulsionata metallo-scoria nella fabbricazione dell 'acciaio. (Concerning the Possibility of the Existence of a Metal-Scale Surface Layer During Production of Steel.) Raffaello Zoja. *La Metallurgia Italiana,* v. 40, Jan-Feb. 1948, p. 13-18.

Different opinions are reviewed. The possibility of the existence of such a layer was experimentally demonstrated.

2b-158. Oxygen in Iron and Steel Making. *Metallurgia,* v. 38, Aug. 1948, p. 188.

Recent developments.

2b-159. The Application of Oxygen-Enrichment to Side-Blown Converter Practice. J. L. Harrison, W. C. Newell, and A. Hartley. *Metallurgia,* v. 38, Aug. 1948, p. 193-200.

Condensed version previously abstracted from *Foundry Trade Journal,* v. 85, Aug. 19, 1948, p. 173-175. See item 2b-154, 1948.

2b-160. Blast Furnace Metal. E. F. Brown. *Iron and Steel,* v. 21, Aug. 1948, p. 367-371.

Experimental methods adopted and the data obtained on the desiliconization of blast-furnace metal by the addition of mill scale to the metal in the runner during casting. (To be concluded.)

2b-161. Development of an Improved Basic Bessemer Steel. H. A. Dickie. *Journal of the Iron and Steel Institute,* v. 159, Aug. 1948, p. 360-375.

The causes of the greater susceptibility of bessemer steel to workhardening and strainage embrittlement, compared with openhearth steel. Methods of removing these causes. The principles of avoiding nitrogen absorption from the air blast and the development of low-phosphorus, low-nitrogen, basic bessemer rimming, and controlled-rimming steels. 21 ref.

2b-162. Use of Oxygen for Decarburization and Melting in Electric Furnaces. J. H. Eisaman. *Blast Furnace and Steel Plant,* v. 36, Sept. 1948, p. 1081-1084.

Previously abstracted from *American Iron and Steel Institute,* Preprint, 1948. See item 2b-128, 1948.

2b-163. Method Devised for Casting Steel From Liquid Phase to Semi-Finished Shape. *Blast Furnace and Steel Plant,* v. 36, Sept. 1948, p. 1105-1106.

Joint development of Republic Steel Corp. and Babcock & Wilcox Tube Co. Results are said to open up possibilities of utmost importance to the entire steel industry through increasing productivity and decentralizing production by simplification of apparatus and increasing the final yield of steel from the original melt. The process permits passing directly from the melt to semifinished sections ready for the secondary mills.

2b-164. Continuous Casting of Semi-Finished Steel at Babcock & Wilcox Beaver Falls Plant. *Industrial Heating,* v. 15, Sept. 1948, p. 1478-1482, 1484, 1498.

Equipment for the above, developed jointly by B. & W. and Republic Steel, in use for production of billets directly from molten steel since March 1948.

2b-165. "Submarine" Ladles Move Molten Iron at Jones & Laughlin Plant. *Industrial Heating,* v. 15, Sept 1948, p. 1500, 1502, 1504.

200-ton mixer-type ladle cars, the metal containers of which are shaped like submarines.

2b-166. Production of Large Steel Ingots. Francis B. Foley. *Industrial Heating,* v. 15, Sept, 1948, p. 1530, 1532, 1538.

Difficulties encountered in pouring large ingots, and various means of overcoming them; prevention of splash in pouring a multiple-heat ingot; mechanical requirements governing the pouring; chill ratio control between ingot and mold; chill ratios from top to bottom of the ingot; and control of ingot pipe and segregation.

2c—Nonferrous

2c-44. Préparation des composés du molybdene et du tungsténe par électrolyse ignée. (Production of Compounds of Molybdenum and Tungsten by Fused-Salt Electrolysis.) J. L. Andrieux and G. Weiss. *Bulletin de la Société Chimique de France,* May-June 1948, p. 598-601.

Methods for preparation of borides, carbides, arsenides, and sulphides of Mo and W, and also for preparation of alloys of W-Sb, Mo-Sb, W-Fe, W-Mn, W-Cr, W-V, W-Ti, and W-Ce, utilizing electrochemical methods. 11 ref.

2c-45. Electrolytic Reduction of Aqueous Tungstate Solutions. M. L. Holt and L. E. Vaaler. *Journal of the Electrochemical Society,* v. 94, Aug. 1948, p. 50-58.

A "catalytic reduction" theory is proposed to explain the electrolytic reduction of aqueous tungstate solutions in the presence of codepositing metals. Two cathode reactions are suggested as being essential to the reduction process. Evidence for the postulated mechanism. 27 ref.

For additional annotations indexed in other sections, see: 3b-132.

A practical presentation of heat treatment theory

PRINCIPLES OF HEAT TREATMENT
by M. A. Grossmann
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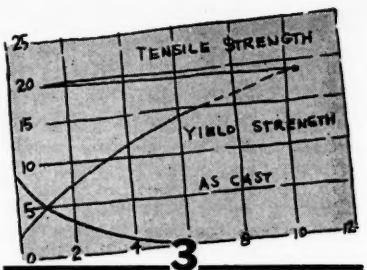

3 PROPERTIES

3a—General

3a-83. Cemented Carbides. E. M. Trent. *British Science News,* v. 1, No. 10, 1948, p. 14-17.

A number of the carbides have been prepared as separate substances. These substances have simple and definite compositions, high electrical and thermal conductivity and a metallic luster, together with very high hardness and little or no plasticity at room temperature.

3a-84. Studies on Some Metal Electrodes. Part I. Oxide-Film Formation on Copper, and the Evaluation of the Standard Electrode Potential of the Metal. Part II. The Behavior of the Copper Electrode in Dilute Copper Sulphate Solutions. A. Riad Tourky and S. E. S. El Wakkad. **Part III. Does the Antimony Electrode Behave Simply as a Metal-Metal Oxide Electrode in Air? Part IV. The Behavior of the Antimony Electrode out of Contact with Air. Part V. The Amphoteric Properties of Antimony Tri- and Pent-oxide.** A. Riad Tourky and A. A. Mousa. *Journal of the Chemical Society,* June 1948, p. 740-763.

Experimental procedures and resultant data for above studies.

3a-85. Further Experiments on the Adhesion of Tin-Base Bearing Alloys. P. G. Forrester and L. T. Greenfield. *Journal of the Institute of Metals,* v. 74, July 1948, p. 525-536.

The nature and properties of the bond between tin-rich alloys and various backing materials were examined by microscopical and mechanical methods, particular attention being paid to the effects of intermetallic compounds at the bond. Embrittlement by Cu_6Sn_5 can largely be avoided by centrifugal casting. Residual Ni and Cr in the steel have no significant effect on bond strength. The bond obtained with tin bronze, phosphor bronze, or gun-metal is of the same order of strength, under static loads, as is obtained with steel. The presence of Cu_6Sn_5 results in some brittleness, but this can largely be avoided by reducing the temperature and time of tinning and lining. Good adhesion can also be obtained on aluminum after suitable preparation. 13 ref.

3a-86. The Theory of the Galvanomagnetic and Thermomagnetic Effects in Metals. E. H. Sondheimer. *Proceedings of the Royal Society,* ser. A, v. 193, July 31, 1948, p. 484-512.

Effect of a magnetic field on the thermo-electric power of a metal containing two overlapping energy bands of normal form. Exact solutions of the transport equation are obtained for the cases of high temperature, low temperature, and very strong magnetic field, and it is shown that the formulas can be generalized to give approximate expressions for all temperatures and

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gation in rimming grades on cold formability of the steel, and shows that under the same processing conditions, a higher sulphur results in a corresponding increase in hardness, a higher yield and ultimate tensile strength, and a decrease in ductility, as measured by elongation and Olsen cup values.

The effect of nitrogen on strain aging is also discussed. Nitrogen in cold reduced sheets can be reduced by annealing at 1200 to 1380° F. in an atmosphere of hydrogen containing less than 0.10% of nitrogen. Altenburger also illustrates by example the effect of vanadium additions to rimming steels. A comparison of tensile strength of sheets containing 0.018% V, tested at room temperature and at 420° F., shows a decrease of about 6000 psi. at the higher temperature—an indication of a so-called "nonaging" steel. Normal, low-carbon rimming steels generally show an appreciable increase in tensile strength (up to 20,000 psi.) at 400 to 500° F.

Properties of Steel

In some engineering applications the value of Young's modulus at elevated temperatures is an important factor. Roberts and Northcliffe (3b-1, Feb. 1948) tested 18 compositions ranging from mild carbon steels to complex alloys of iron, chromium, nickel and tungsten.

Considerable difficulty is encountered in measuring the modulus at high temperatures by the usual static methods, since only small stresses may be used if creep in the specimen is to be avoided. Roberts and Northcliffe therefore employed a vibration method in which the displacement under stress is small enough to preclude the danger of creep. This method consists essentially of setting up transverse vibrations in a cylindrical rod and measuring the resonant frequency. This frequency is a function of the dimensions of the rod, density, and Young's modulus of the steel. The relationship is expressed by the formula:

$$E = 1.041 \times \left(\frac{l}{d}\right)^4 \times \frac{m}{l} \times f^2 \times 10^{-8} \text{ tons per sq. in.}$$

where:

l = length of bar in cm.

d = diameter of bar in cm.

f = natural frequency of bar in cycles per sec.

m = weight of bar in grams.

With this method, the only difference between determinations made at high temperatures and those made at room temperature is that the bar must be suspended inside a furnace with a uniform temperature distribution. The accuracy of the vibration method in determining Young's modulus is believed to be ± 1%.

In all steels tested, Young's modulus decreased about 25% between room temperature and 600° C. (1110° F.), the decrease being almost linear with increasing temperature. As an example, for mild steel the values of Young's modulus were as follows:

TEMPERATURE	YOUNG'S MODULUS
20° C (68° F.)	30,240,000 psi.
200° C (390° F.)	28,448,000
400° C (750° F.)	26,432,000
600° C (1110° F.)	23,296,000

Above 600° C. and up to 800° C. the modulus for austenitic steels continues to decrease linearly, but on ferritic steels the rate of fall of Young's modulus above 600° C. increases considerably.

An interesting series of papers dealing with brittle fracture of mild steel plates was presented at a British conference (3b-5, Feb. 1948). Professor Baker calls attention to the fact that, in the examination of a large number of failures of welded ship plates, the common characteristic is the development of large cracks —often extending for many feet— without any indication of plastic deformation before fracture. Paint or scale still adhere to the surface of the plate even in the immediate vicinity of the crack. In riveted structures, such failures are very rare. It is natural, therefore, that the primary or local effects of the welds should first become suspect.

It is well known that high residual stresses are produced in the process of welding. Experience with plate-girder bridges in Germany, fully welded from a high-tensile structural steel, points up this fact. These bridges developed cracks similar to those observed in ship plates, and in a study of the causes of failure, three identical plate girders, about 3 ft. deep and 20 ft. long, were fabricated by welding. Two of these girders were stress relieved at 600° C. (1110° F.); they deformed plastically and could not be fractured under the test loads employed. The one girder which was not stress relieved fractured suddenly with a loud report while under load, and showed comparatively little indication of plastic deformation.

Professor Baker is convinced, however, from his experiments with welded plates under restraint, that if the pressure of high residual stresses were the major factor in failures of welded structures, no welded ship would survive for very long. The fact that many such ships have been in service for many years indicates that susceptibility of some of the ship plates to brittle fracture is the prime factor inducing failure.

Analyzing the basic reasons why a conventional static tensile test does not measure susceptibility of steel plates to brittle fracture, Dr. Orowan (3b-5, Feb. 1948) states that every material is capable of brittle fracture under certain conditions. The condition for brittle fracture is that the tensile stress must reach a certain critical value — the so-called brittle strength or cleavage strength. Whether a material shows brittle or ductile fracture depends entirely on the relative magnitude of the yield stress and of the cleavage strength. Some materials show excellent ductility in the ordinary tensile test, because the highest tensile stresses do not reach the value of cleavage strength, but fail with a brittle fracture if a notch or a crack is present, because then the triaxial state of stress can raise the maximum tension to the value of cleavage strength.

The question raised by Orowan is why susceptibility to brittle fracture is greater on some steels than on others. In a notched specimen of an ideally plastic material he found that the tensile stresses cannot exceed more than 3.3 times the ordinary yield strength. Orowan reasons that if the brittle or cleavage strength is less than the yield stress at the beginning of plastic deformation, the material is completely brittle and plastic deformation cannot occur. If the brittle strength is greater than the highest value which the uniaxial stress attains (owing to strain hardening) in the usual tensile test, but less than about three times this value, the material is ductile but notch-brittle. Finally, if the brittle strength is greater than about three times the highest possible yield stress, the material is ductile and will show no notch brittleness. If the yield stress is denoted by Y, the brittle fracture stress by B (both Y and B depend on the plastic strain), and the value of Y corresponding to zero strain is denoted by Y', the following relationship may be expected:

The material is brittle if $B < Y'$.

The material is ductile but notch-brittle if $Y' < B < 3\,Y$.

The material is not notch-brittle if $3\,Y < B$.

Thus, whether the material is notch-brittle or not depends on the very small margin between B and $3\,Y$. In some instances a slight decrease in the cleavage strength may shift the material into the notch-brittle group. This is the reason why notched-bar tests are often so erratic, and why notch brittleness is so sensitive to slight variations in composition, previous treatment, and temperature.

Orowan reasons further that since the occurrence of notch brittleness depends on the relative magnitude of yield stress and brittle strength, it is these two properties that must be investigated in the study of problems of notch brittleness. The yield stress is easily obtained by usual tests. The

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all fields. The transverse galvano and thermomagnetic effects, and formulas which hold for free electrons which are generalized so as to be approximately valid for all temperatures. 22 ref.

3a-87. Production Data Sheet. *Production Engineering & Management,* v. 22, Sept. 1948, p. 73.

Compositions of eight stainless steels and comparative properties of the stainless steels and carbon steel, Ni, Cu, Al, Mg, and Be.

3a-88. Special Magnetic Alloys and Applications. G. W. Elmen and E. A. Gaugler. *Electrical Engineering,* v. 67, Sept. 1948, p. 843-845. A condensation.

Superior operating characteristics may be obtained in contact rectifiers and magnetic amplifiers by the use of alloys having rectangular hysteresis loops. Such loops may be produced by drastic cold rolling and final special annealing, or by heat treating in a magnetic field.

3a-89 Neuzeitliche Gleitlagerwerkstoffe und ihre Verwendung. (Modern Bearing Metals and Their Applications.) O. H. Hummel. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 427-431.

This survey is based on analysis of results of 2448 experiments made over a 4-yr. period. Results are summarized in a table which permits selection of the proper metal for any given load.

3a-90. Influence de la constitution physico-chimique des alliages métalliques sur leurs propriétés élastiques. (Influence of Physicochemical Constitution of Alloys on Their Elastic Properties.) Robert Cabarat, Léon Guillet, and René Le Roux. *Comptes Rendus,* v. 226, April 26, 1948, p. 1374-1376.

The above was investigated by a dynamic method using frequencies of 10,000 to 50,000 cycles per sec., thus causing only small deformations and avoiding the temporary or permanent modifications resulting from mechanical testing. Data for Al and Cu alloys.

3a-91. Experiences concernant l'homogénéité élastique des métaux. (Elastic Homogeneity of Metals.) Constantin Salceanu and Marium Borneas. *Comptes Rendus,* v. 226, May 3, 1948, p. 1422-1424.

Influence of tension over the period of oscillation of a torsional pendulum, variation of the plasticity of the metal threads with the amplitude of oscillation having been previously established. Method and apparatus used and results.

3a-92. Sur une méthode d'étude de la texture magnétique. (Concerning a Method for Study of Magnetic Structure.) Paul Abadie and Israel Epelboim. *Comptes Rendus,* v. 226, May 24, 1948, p. 1706-1708.

Results of use of the method of magnetic spectra for determination of spin orientation of carbonyl iron powder, cold-worked iron, and permalloy. Effects of different degrees of electrolytic polishing on the magnetic structure of a permalloy containing 76% Ni.

3a-93. Influence de l'aimantation sur le pouvoir thermo-électrique des milieux ferromagnétiques. (Influence of Magnetization on the Thermo-Electric Force of Ferromagnetic Media.) Jean Bouchard. *Comptes Rendus,* v. 226, May 24, 1948, p. 1708-1710.

Influence on different ferromagnetic materials such as Ni, Cu, and Al alloys; Fe; steels, and ferronickels. The theory of the observed phenomena.

3a-94. Nouvelle méthode pour la mesure de la viscosité des métaux. (A New Method for Determination of the Viscosity of Metals.) Constantin Salceanu. *Comptes Rendus,* v. 226, May 31, 1948, p. 1798-1800.

Modification of a previously described method, based on the determination of the logarithmic decrement of the oscillations of a torsional pendulum. Comparative data for Al, Fe, steel, Pb, Ag, Ni, Cu, Pt, and W.

3a-95. Properties of Metallic Surfaces. R. M. Burns. *Journal of the Electrochemical Society,* v. 94, Aug. 1948, p. 14N-16N.

Introductory address before Pittsburgh International Conference on Surface Reactions, Pittsburgh, June 7, 1948. Lubrication and wear, corrosion, oxidation and tarnishing, and catalysis.

3a-96. Some Properties of a Mechanical Model of Plasticity. H. F. Bohnenblust and Pol Duwez. *Journal of Applied Mechanics,* v. 15 *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 222-225.

An analytical expression for the stress-strain curve and the hysteresis curve of a metal in the plastic range can be deduced from a model. A further analysis of the model leads to the computation of the change in potential energy of the metal due to work hardening.

3a-97. The Stress-Strain Laws of the Mathematical Theory of Plasticity—A Survey of Recent Progress. William Prager. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 226-233.

Typical stress-strain laws of flow and deformation types with particular reference to the conditions of continuity and uniqueness which these laws must fulfill if they are to make sense physically. Alternative forms of some of these laws, and conditions under which different laws yield identical results. How these laws may be generalized so as to fit test data more readily. Methods of integration and the use of variational principles. 50 ref.

3a-98. Stress-Strain Relations for Finite Elastoplastic Deformations. J. E. Dorn and A. J. Latter. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 234-236.

Certain difficulties are involved in adapting known methods for describing finite strains to stress-strain analyses in elastoplastic materials. A mathematical analysis which attempts to surmount these difficulties and which is an extension of methods originally described to include elastic as well as plastic deformations. 14 ref.

3a-99. A Generalized Deformation Law. E. A. Davis. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers, v. 70),* Sept. 1948, p. 237-240.

According to Hooke's law, the magnitude of infinitesimal elastic strains depends upon two independent constants. Equations are developed which express the magnitude and the distribution of the strains in terms of two independent functions of the stresses. The equations are easily adaptable to the relations between the strain rates and the stresses in combined stress-creep tests. The author believes that two independent functions are necessary and that behavior under a state of combined stress cannot be predicted from data obtained in pure-tension tests.

3a-100. The General Proof of the Principle of Maximum Plastic Resistance. A. H. Philippidis. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 241-242.

A mathematical development.

3a-101. The Propagation of Plasticity in Uniaxial Compression. M. P. White and LeVan Griffis. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 256-260.

Results of a theoretical investigation of the mechanism of uniaxial compression impact on elastic-plastic materials. It was concluded that four different kinds of behavior can occur, depending upon the impact velocity. Beginning with low velocities, behavior is first similar to that found in tension. Within the next range, stress and strain are propagated as a shock-type wave; at higher velocities "flowing" deformation occurs; finally, at velocities greater than the speed of an elastic wave, behavior is essentially that of a fluid.

3a-102. The Interaction of Discontinuity Surfaces in Plastic Fields of Stress. Alice Winzer and G. F. Carrier. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 261-264.

A fundamental solution for problems associated with discontinuity surfaces in the field of stress has been developed by W. Prager, but its accuracy has not been established under all conditions. Results of a study of the above limited case.

3a-103. Proton Stopping Power of Solid Beryllium. C. B. Madsen and P. Venkateswarlu. *Physical Review,* ser. 2, v. 74, Sept. 15, 1948, p. 648-649.

The energy loss of protons penetrating beryllium foils of different thicknesses was determined as a function of the proton energy by measuring the shift of those potentials at which a thin aluminum target gives resonance radiation. The experimental points fit within $\pm 2\%$ a theoretical curve corresponding to an average ionization energy of 64 ± 5 ev., which is in agreement with a recent theory for the stopping power of metals.

3a-104. The Spectral Emissivity of Iron and Cobalt. H. B. Wahlin and Harry W. Knop, Jr. *Physical Review,* ser. 2, v. 74, Sept. 15, 1948, p. 687-689.

The spectral emissivity of iron and cobalt was determined as a function of the temperature. Sharp, definite changes were observed in iron at the A_3 and A_4 point and at the Curie point for cobalt.

3a-105. Hall and Kerr Effects at Microwave Frequencies. S. P. Cooke. *Physical Review,* ser. 2, v. 74, Sept. 15, 1948, p. 701-702.

Apparatus for observation of the above, and certain qualitative results for Bi, Fe, Ni, Permalloy (45% Ni), Moly-Permalloy (4% Mo, 79% Ni), Kovar, and various other metals.

3b—Ferrous

3b-127. Phosphorus In Cast Iron (Concluded). E. Piwowarsky. *Pig Iron Rough Notes,* Spring-Summer 1948, p. 18-23. (Translated from the German.)

Data on effect of phosphorus on structure and mechanical properties. 13 ref.

3b-128. Nodular Cast Irons, Their Production and Properties. (Concluded.) H. Morrogh and J. W. Grant. *Foundry Trade Journal,* v. 85, July 29, 1948, p. 105-110.

Data on acicular and martensitic cast irons, and influence of heat treatment on nodular cast irons. Tables of properties and effects.

3b-129. Cracking of Steel in Nitrate Solutions. *Engineer,* v. 186, July 30, 1948, p. 110.

(Turn to page 10)

brittle strength is a much more elusive quantity, but could be conveniently measured in steels by tensile tests at very low temperatures—for instance, the temperature of liquid air. This method, according to Orowan, is sounder than one employing notched-bar tests for a fundamental investigation of the problem, primarily because the stress distribution in a notched specimen is so complex that the actual local values of the stress cannot be obtained.

Differences in the cleavage strength of carbon steels may be due to differences in crystallographic structure, impurities precipitated along crystallographic planes, or to minute cracks. Presence of minute cracks may possibly be revealed by damping tests at high frequencies. Extremely small amounts of impurities can precipitate along certain crystallographic planes and thus weaken the cleavage strength of these planes. A study of impurities present in commercial steels may, therefore, furnish valuable data.

In specific failures of welded ship structures, fabricating conditions cannot be ruled out as important contributing factors. It is difficult to fabricate a complex ship structure without introducing some degree of varying stress because of imperfect fit of the welded members. Considerable force may be necessary to bring the large and stiff prefabricated units together, thus introducing high initial stresses distributed over the whole cross section of the ship.

The submerged part of the hull of a ship will remain at a relatively constant temperature, while the upper deck will be subjected to considerable temperature changes even in the course of a single day. This may build up internal stresses. Vibration of the structure also points to fatigue as a contributing factor which may initiate a crack.

Fatigue is probably a more important factor in welded than in riveted ships, because of the greater rigidity and the smaller damping capacity of welded structures. It is conceivable that resonance might be set up more easily in any part of a welded ship if a periodic disturbance of a suitable frequency were set up by the engines or other machinery. These vibrations superimposed on an existing static stress near the yield point of the material might cause brittle fracture.

Cleavage fracture in ship plate was also the subject of a paper by Boodberg and co-workers (3b-64, June, 1948). They describe various tests conducted at the University of California to determine possible causes of brittle failure that occurred in all-welded merchant ships during the war. Notched plates of various widths ranging from 3 to 108 in. were tested over a range of temperatures. The tests were made on three lots of semi-killed steel, one lot of nickel-bearing steel, one lot of fully killed steel, and one lot of quenched and drawn steel.

This investigation showed that the speed of propagation of a cleavage fracture was sometimes on the order of 1 mile per sec. For one of the 72-in. wide specimens tested at 32° F. which failed by cleavage, the velocity near the notch was found to be 4600 ft. per sec., halfway between the notch and the edge of the specimen it was 3250 ft. per sec., and near the edge the velocity dropped to 3000 ft. per sec. On another 72-in. specimen the velocities ranged from 6600 ft. per sec. to 3500 ft. per sec. These measurements were made with a probable error of ± 200 ft. per sec.

Velocity of crack propagation was found to be a function of stress and temperature. In the regions where the magnitude of stress was low, crack propagation velocities of only 200 ft. per sec. were observed. The velocities increased at lower temperatures.

Chemical composition and deoxidation practice appeared to exercise a strong effect on the transition temperature from ductile to brittle fracture. Thus, the 3.25% nickel steel had a lower transition temperature than the plain carbon steels. Of two carbon steels in which nitrogen was the only significant variable, the steel with 0.004% nitrogen had a much lower transition temperature than the steel with 0.009% nitrogen. (On the 12-in. specimen, ¾-in. thick, the transition temperature of the low-nitrogen steel was about 20° F., while the high-nitrogen steel had a transition temperature about 100° F.)

The greatest variation in transition temperature was found on semi-killed steels; it varied from below freezing to well above room temperature. On the killed steels it was uniformly higher. Heat treatment had a beneficial effect on transition temperature. Quenching and drawing lowered the temperature at which brittle fracture occurred. Further heat treatment, which eliminated free ferrite from the microstructure, resulted in further improvement. With a given type of notch and a fixed width of plate, the transition temperature was found to increase with increasing thickness of the plate.

Professor De Garmo (22b-82, April 1948) reported results of tests on ten full-scale welded hatch corners. Composition of the steel was 0.24% C, 0.49% Mn, 0.015% P, and 0.033% S.

To apply the load in testing these full-scale members, heavy pulling tabs were attached to each end of the specimen. To supply some transverse restraint (such as would be supplied by the remaining structure in the actual ship), three transverse restraining beams were attached to all specimens above deck. Energy absorption measurements were made on all specimens by measuring the strain which took place between the pins and the two pulling tabs.

In all tests cleavage fractures were obtained. In several instances, a crack would originate and progress for a few inches, accompanied by a slight decrease in maximum load. This would be followed in an instant by major failure of the specimen; complete or nearly complete failure of the deck always occurred.

The tests reported by De Garmo furnished interesting data dealing with design modification of the structure tending to reduce the hazard of brittle failure in ship structure. Four different types of design were evaluated in the laboratory test by using energy absorption as an index of quality. In a discussion of De Garmo's paper, MacCutcheon cites service records kept by the Coast Guard of ships on which the four types of hatch-corner design were used. These records were in complete agreement with the results of laboratory tests.

An Air Compressor Car Provides Power to Dump Slag When Coupled With Diesel Engines at Tennessee Coal Iron & R. R. Co. *(See page 11)*

Results of observations and tentative theory for this cracking.

3b-130. Low-Alloy Steels. F. J. Erroll. *Automobile Engineer,* v. 38, Aug. 1948, p. 289-290.

Properties and compositions of several new American materials developed for vehicle construction.

3b-131. Field Tests on Diesel Liners Run Up to 67,000 Hours. T. E. Eagan. *Nickel Topics,* v. 1, Aug. 1948, p. 2-3.

Results of tests on seven alloy compositions. Evidence indicates that the most satisfactory iron as far as wear resistance is concerned in the machinable classes seems to be one which has a pearlitic structure and Type A graphite, alloyed with 1.00 to 1.50% Ni, 0.30 to 0.40% Cr, and 0.25 to 0.55% Mo.

3b-132. Viscosity. (Concluded.) E. T. Linacre. *Iron and Steel,* v. 21, Aug. 1948, p. 363-366.

A critical survey of the viscometry of molten iron-carbon alloys. Methods of measurement and tables of data. 43 ref.

3b-133. Strain Aging Criteria. George Sachs. *Iron and Steel,* v. 21, Aug. 1948, p. 385-388.

Susceptibility of low-carbon steels, and results of tests. 72 ref.

3b-134. Refinery Tube Failures; Excessive Temperatures Found Chief Cause. *Petroleum Processing,* v. 3, Sept. 1948, p. 829-831. Based on "Properties of Carbon and Alloy Seamless Steel Tubing for High-Temperature and High-Pressure Service", Technical Bulletin No. 6-E; Babcock & Wilcox Tube Co., Beaver Falls, Pa.

The most common causes of failure, regardless of metal used, were found to be corrosion, scaling, and creep-rupture due to excessive temperature. Results of practical experience in study of tube failures over a 25-yr. period. Properties and applications of a series of steels are concisely stated.

3b-135. Caratteristiche meccaniche e rendimenti pratici di alcuni tipi di acciai rapidi. (Mechanical Properties and Serviceability of Certain High-Speed Steels.) Mario Ongaro. *La Metallurgia Italiana,* v. 40, Jan.-Feb. 1948, p. 19-28.

Hardness, tensile strength at room and various elevated temperatures, and cutting properties of three tool-steel compositions.

3b-136. Interprétation de l'influence d'un champ magnétique sur le frottement intérieur des corps ferromagnétiques. (Interpretation of the Influence of the Magnetic Field on the Internal Friction of Ferromagnetic Substances.) Christian Boulanger. *Comptes Rendus,* v. 226, April 26, 1948, p. 1341-1343.

The phenomenon was investigated for different metals and alloys. Plotted curves and their extrapolations indicate that they may be interpreted satisfactorily by use of the theory of P. Weiss.

3b-137. Chart for Determining Properties of Round Aircraft Tubing. Benjamin Ostlind. *Product Engineering,* v. 19, Sept. 1948, p. 165.

Chart comprises several groups of empirical curves including area of metal in the cross section, weight per lineal ft., D/T ratio, moment of inertia, and radius of gyration.

3b-138. Experimental Studies of Biaxially Stressed Mild Steel in the Plastic Range. S. J. Fraenkel. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 193-200.

Static tests of tubular specimens of medium steel under biaxial stresses and at room temperature made to obtain an experimental check on the so-called "third rule of plastic flow"; to study the absorption of energy as a function of the biaxial-stress ratio; and to determine the effect of the path of loading as symbolized by the strain path. A relation between strain energies absorbed under biaxial and uniaxial stress states up to a common maximum strain is tentatively formulated.

3b-139. Behavior of Steel Under Biaxial Stress as Determined by Tests on Tubes. H. E. Davis and E. R. Parker. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 201-215.

Tests on 12 5¼-in. diameter thin-walled tubes of low-carbon steel subjected to various conditions of biaxial stress. These experiments were a part of a larger investigation on the behavior of ship-plate steel under multiaxial-stress conditions. Ductility under various biaxial stress conditions and at 70 and −138° F. is reported. 13 ref.

3b-140. The Effect of Size and Stored Energy on the Fracture of Tubular Specimens. E. A. Davis. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 216-221.

Results of internal-pressure tests on ship-steel specimens for three sizes of specimens. Both pure internal-pressure and pure circumferential-tension tests were made. The size effect was found to be negligible.

3c—Nonferrous

3c-64. Nickel in Non-Ferrous Castings. *Nickel Bulletin,* v. 21, June 1948, p. 78-81.

Properties and applications of: Al alloys containing nickel; Ni in bearing alloys; Cu alloys containing Ni; Sn bronzes; high tensile brass; Al bronze; Ni silver; Cu-Ni castings; Ni castings; high-Ni bronzes; monel castings; and special high-Ni alloys.

3c-65. A Rare Metal in Everyday Use. M. Schofield. *Discovery,* v. 9, Aug. 1948, p. 244-246.

Tantalum, its source, history, uses, and properties.

3c-66. German Magnetic Alloy Has Important Applications. G. W. Elman and E. A. Gaugler. *Power Generation,* v. 52, Sept. 1948, p. 64-67.

The significance and importance of magnetic alloys having rectangular hysteresis loops in the design of contact rectifiers and magnetic amplifiers. Deals especially with alloys of the Fe-Ni and Fe-Ni-Co series developed in Germany during the war.

3c-67. Berucksichtigung von Temperaturschwankungen bei der Härteprüfung von Lagermetallen. (Effects of Temperature Fluctuations During Hardness Testing of Bearing Metals.) V. Schneider. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 423-425.

Results of hardness tests on white-metal bearings in the temperature range −25 to 40° C.

3c-68. Lagerschalen aus Verbundguss. (Bearing Shells From Plated Castings.) A. Schimmel. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 426.

The nature and function of the above and the behavior, properties, and production of different bearing alloys.

3c-69. The Surface Tension and Density of Lead-Antimony and Cadmium-Antimony Alloys. H. T. Greenaway. *Journal of the Institute of Metals,* v. 74, Nov. 1947, p. 133-148.

Research on several aspects of the surface tension of liquid metals and alloys, including the significance of this property in casting and soldering. Work of earlier investigators; construction and checking of the maximum-bubble-pressure apparatus; a simple, accurate method for measuring the densities of molten alloys.

3c-70. Etude de la variation de résistance électrique avec la température de l'alliage ferromagnétique MnSb. (Study of the Variation of Electrical Resistance With Temperature of the Ferromagnetic Alloy MnSb.) Georges Mannevy-Tassy. *Comptes Rendus,* v. 226, May 19, 1948, p. 1592-1593.

Experimental method and results.

3d—Light Metals

3d-42. Tvarené polotovary z hliniku a z hlinikovych slitin. (Formed Aluminum Products and Semifinished Shapes.) R. Henych and B. Puchnar. *Hutnické Listy,* v. 3, April-May, 1948, p. 109-115.

Composition, mechanical properties, and other characteristics determining the applications of products made in Czechoslovakia.

3d-43. Hlinik a jeho slitiny. (Aluminum and Its Alloys.) Jiri Mackievic. *Hutnické Listy,* v. 3, April-May 1948, p. 98-109; June 1948, p. 171-178.

First installment classifies all commercial Al alloys sold under various trade names into main groups and subgroups according to their chemical composition. Group differences and similarities are outlined. Second part deals with the constitutional diagram of binary Al alloys and relationships to mechanical properties. The influence of individual alloying elements. 17 ref.

3d-44. Investigations on Aluminum Alloys of High Strength at Room Temperature. (Concluded.) B. W. Mott and J. Thompson. *Metal Treatment and Drop Forging* v. 15, Summer 1948, p. 91-105.

Test on fatigue and stress-corrosion resistance. Microstructures observed.

3d-45. Aluminium Alloy Casting Developments. E. G. West. *Machinery Lloyd* (Overseas Edition), v. 20, July 31, 1948, p. 68-78.

Development of the present-day alloys; improvements in casting practice; and expansion of the fields of application. 12 ref.

3d-46. A Die-Casting Aluminium Alloy. *Engineer,* v. 186, Aug. 6, 1948, p. 141.

Chemical composition and physical and mechanical properties for Hiduminium 51.

3d-47. Hot-Shortness of Some High-Purity Alloys in the Systems Aluminium-Copper-Silicon and Aluminium-Magnesium-Silicon. P. H. Jennings, A. R. E. Singer, and W. I. Pumphrey. *Journal of the Institute of Metals,* v. 74, Jan. 1948, p. 227-248.

Use of the ring-casting test and the restrained-weld test. Ternary hot-shortness diagrams for both systems showing the relative welding and casting behavior of alloys in the ranges 0 to 10% copper, 0 to 4% silicon; and 0 to 10% magnesium, 0 to 5% silicon. The original hot-shortness theory use extended to ternary systems. 16 ref.

3d-48. A Consideration of the Constitution of Aluminium-Iron-Silicon Alloys and Its Relation to Cracking Above the Solidus. P. H. Jennings and W. I. Pumphrey. *Journal of the Institute of Metals,* v. 74, Jan. 1948, p. 249-258.

The question of whether the susceptibility to cracking is related to the constitution, and if it is, in what manner. From literature concerning the constitution of the Al-rich

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Equipment for the Steel Plant

Products, Processes and Techniques Developed During the Past 12 Months for the Production of Better Iron Alloys

THE PAST 12 months have seen the continuance of the postwar struggle to increase production of iron and steel so as to satisfy the relentless and unceasing demands of the fabricating and consuming industries. The methods and expedients for so doing, the reasoning behind the inability to keep up, have formed the subject of a vast quantity of printed matter in the public, business and technical press.

Not the least important to the technical and business reader are the descriptions of new products, equipment and methods which in some manner help to further and increase production without a concommitant increase in cost. A cross section of these products is given below, described largely in the words of the manufacturers and producers. Further information may be obtained by using the coupon on page 53 and circling the proper number.

Blast Furnace Refractories

The advantages of carbon refractories for the blast furnace are being put to the test with the construction of several new units and rebuilding of old ones during the past year. Three new furnaces have been built by **Carnegie-Illinois Steel Corp. (682)**, two at its South Chicago Works and the other at Gary, Ind., each capable of producing more than 1500 tons of iron per day.

The hearths of these furnaces are made of big carbon blocks, joined together with rammed carbon paste. Such hearths are impervious to iron penetration, expand very little under heat, and do not disintegrate with changes in temperature.

For the hearth bottoms, blocks 22½ in. thick, 30 in. wide and up to 15 ft. long were used, with smaller blocks for the walls. The blocks are made of a mixture of sized petroleum coke and low-ash anthracite, heated to drive off volatile matter. Mixed with pitch, they were extruded by a hydraulic press at 2000 psi., then baked in sealed ovens at temperatures of 1800 to 2000° F. for periods up to seven weeks.

Savings in fabrication expense and decrease in installation time were realized through the installation of the first Thacher type carbon blocks in a furnace of **Interlake Iron Corp. (683)**. Developed by **Great Lakes Carbon Corp. (684)**, only 53 of the new type blocks were needed, instead of approximately 250 carbon blocks of smaller size. Twenty bottom blocks 30 in. thick were laid in a single layer, while the 30 wall blocks measured 24 in. thick and 10 ft. high. Three specially designed blocks at the iron notch complete the carbon lining.

A carbon block shell was used in the relining of a 900-ton blast furnace by **Armco Steel Corp. (685)** in the record time of 33 days. Instead of the usual metal stock line in the furnace, Armco installed ceramic bricks, made from fused alumina and zirconium. Workmen installed 400,000 9-in. bricks and set 254,610 lb. of carbon blocks.

Other Refractories

A new design in refractory cupola blocks is in production by **Harbison-Walker Refractories Co. (686)**. The new shape is of standard 9x6x4-in. dimensions, but features alternate convex and concave ends which form a highly flexible but tight fitted-curve end joint that maintains a complete contact over the entire end surfaces regardless of the diameter of the lining. Thus, a number of various diameters, ranging from 2 to 8 ft. and larger inside diameter, in multiples of 3 in., can be set entirely of whole blocks. The new blocks are a fireclay product of various blends and burnings for particular cupola services.

Workmen Lay Big Blocks of Solid Carbon Refractory for Hearth of Carnegie - Illinois Blast Furnace

Harbison-Walker's Universal Cupola Blocks

Titanium Alloy Mfg. Co. (687) has announced a new material, stabilized zirconia. It has an unusually high melting point and excellent heat shock resistance.

Handling Equipment

Typical of the increasing use of diesel-electric locomotives in steel plants is the replacement at Weirton Steel Co. of nine steamers by seven diesel-electrics, with an increase of 25% in output of work. In switching operations three diesel-electrics are doing the work of four steam engines. The locomotives were built by American Locomotive Co. and powered by **General Electric Co. (688)**.

Replacement of steam with diesel locomotives in the yards of **Tennessee Coal, Iron and Railroad Co. (689)** necessitated the creation of a new method of emptying blast furnace slag pots. Compressed air is now used instead of steam to drive a piston which tips the pot to pouring position. A special air compressor car is coupled between the locomotive and

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alloys in the Al-Fe-Si system, it is clear that, in alloys containing more iron than silicon, the theoretical solidus temperature is not apparent in practice, the completion of freezing occurring at much higher temperature. 14 ref.

3d-49. The Young's Modulus of Some Aluminium Alloys. N. Dudzinski, J. R. Murray, B. W. Mott, and B. Chalmers. *Journal of the Institute of Metals,* v. 74, Jan. 1948, p. 291-310.

Various binary, ternary, and complex Al-base alloys were prepared to investigate the possibility of increasing their Young's modulus. All the five elements investigated were found to enhance its value, Mn having the greatest effect and the elements Be, Co, Ni, and Si having decreasing effects in that order. The possibility of developing alloys combining high strength with improved Young's modulus.

3d-50. The Moduli of Aluminium Alloys in Tension and Compression. S. F. Grover, W. Munro, and B. Chalmers. *Journal of the Institute of Metals,* v. 74, Jan. 1948, p. 310-314.

This article is an appendix to the one preceding it. (See above abstract.) Tests designed to determine whether, for aluminum alloys, the Young's modulus in tension is the same as the Young's modulus in compression. Both bar and sheet stock were tested. Results indicated that, within limits of experimental error, the moduli in tension and compression are the same.

3d-51. The Effect of 1% Silicon on the Melting Points of Aluminium-Magnesium-Manganese-Zinc Alloys. H. J. Axon, E. Butchers, and W. Hume-Rothery. *Journal of the Institute of Metals,* v. 74, Feb. 1948, p. 330-344.

Melting points of Al-Mg-Mn-Zn-Si alloys containing 1% Si were determined for alloys containing from 0 to 8% Mg, 0 to 2% Mn, and 0 to 8% Zn. Results are compared with those for the corresponding quaternary Al-Mg-Mn-Zn alloys. If the Mg content is less than 1 or 2%, the melting point of the alloy may be lowered markedly by the addition of 1% Si.

3d-52. The Effect of Vibration on a Precipitation-Hardening Aluminium Alloy. R. F. Hanstock. *Journal of the Institute of Metals,* v. 74, May 1948, p. 469-492.

The dynamic properties of a precipitation-hardening Al alloy were investigated by determining the relation between damping capacity and strain amplitude for various metallurgical conditions of the alloy. Suggests that strain-dependent damping capacity is attributable to dislocations generated under the combined influence of strain and thermal fluctuations. 16 ref.

3d-53. Tvarené polotovary z hlinikovych slitin typu Al-Zn-Mg o vysoké pevnosti. (High Strength Aluminum-Alloy Semifinished Products of the Al-Zn-Mg Type.) Jiri Chvojka, *Hutnické Listy,* v. 3, June 1948, p. 178-182.

Development and influence of different alloying elements and of heat-treatment.

For additional annotations indexed in other sections, see:
2b-161; 4a-39; 4d-25; 8-210; 9b-47; 19a-185-186-198; 19c-21; 24b-85; 27a-125.

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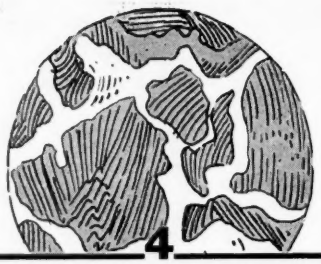

4 CONSTITUTION and STRUCTURE

4a—General

4a-39. Application of Dynamic Similarity to Metal Structures With Elastic and Plastic Flow. M. W. Thring. *Nature,* v. 162, July 31, 1948, p. 193-194.

In the attempt to attain dynamic similarity for fluid-flow systems, different dimensionless criteria appear according to whether momentum and viscosity, or momentum and gravity, are the dominant factors. Shows that a similar argument applied to the attempt to attain dynamic similarity for the flow of a metal structure gives two alternative dimensionless criteria according to whether momentum and elasticity or elasticity and plasticity are the dominant factors.

4a-40. Theory of Strain Interaction of Solute Atoms. C. Zener. *Physical Review,* ser. 2, v. 74, Sept. 15, 1948, p. 639-647.

The present study was undertaken for the purpose of understanding the strain interaction of interstitial solute atoms in body-centered cubic metals. Many of the problems encountered were found to be common to substitutional as well as to interstitial solutions. Primary emphasis is therefore placed upon the general theory.

4b—Ferrous

4b-56. Influence of Low Temperatures on the Mechanism of the Austenite-Martensite Transformation. Jozef Mazur. *Nature,* v. 162, July 31, 1948, p. 184-185.

Results of systematic investigations by X-ray diffraction methods of the influence of low temperatures on the lattice parameter of austenite and martensite and on the axial ratio c/a in martensite using two plain carbon steels containing 0.89 and 1.2% carbon, respectively.

4b-57. Investigation on Dissolved Gases in Cast Iron. J. E. Hurst. *Pig Iron Rough Notes,* Spring-Summer, 1948, p. 4-7.

Results of observations on gases evolved on solidification of molten pig iron and the influence of casting temperature on the CO_2, CO, H_2 and N_2 content. (To be continued.)

4b-58. Equilibrium of Iron-Carbon-Silicon and of Iron-Carbon-Manganese Alloys With Mixtures of Methane and Hydrogen at 1000°. Rodney P. Smith. *Journal of the American Chemical Society,* v. 70, Aug. 1948, p. 2724-2729.

The carbon content of several Fe-Si alloys (1.2-15% Si) and of a number of Fe-Mn alloys (4.0-14.5% Mn) in equilibrium with various mixtures of CH_4 and H_2 of known composition at 1000° was determined. For the silicon alloys the measurements covered both the austenite and the ferrite regions. The activity of carbon relative to graphite is given for each system. Phase boundaries in a portion of each of the two three-component systems. 16 ref.

4c—Nonferrous

4c-52. The Thermal Etching of Silver. B. Chalmers, R. King and R. Shuttleworth. *Proceedinys of the Royal Society,* ser. A, v. 193, July 21, 1948, p. 465-483.

The mechanism whereby grain boundaries are delineated and striations formed on polished surfaces of heated metal specimens was examined. Experiments on electrolytically polished silver show that grooves form at grain boundaries at temperatures as low as 300 and striations at 500° C. in air. A furnace for high-temperature photomicrography, suitable for temperatures up to about 950° C. is described. 40 ref.

4c-53. Zur Metallurgie der Bleibronzen fur Verbundgussgleitlager. (The Metallurgy of Lead Bronzes for Cast-Alloy Bearings.) F. Bollenrath. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 417-422.

The importance of hydrogen and oxygen in lead-bronze bearings, the solubility of hydrogen and phosphorus in Cu-Pb alloys, the effect of the phosphorus on the diffusion of copper in iron, and the importance of phosphorus on the fusibility of lead bronzes in steel shells. 14 ref.

4c-54. The Constitution of Aluminium-Copper-Magnesium-Zinc Alloys at 460° C. D. J. Strawbridge. W. Hume-Rothery, and A. T. Little. *Journal of the Institute of Metals,* v. 74, Dec. 1947, p. 191-225.

The equilibrium diagram of the above system was determined by microscopic examination of alloys annealed for long periods. The range of composition investigated lies within the limits: zinc 0 to 8, copper 0 to 55, and magnesium 0 to 30%. 11 ref.

4c-55. Sur une transformation du sélénium a basse température. (Concerning a Low-Temperature Transformation of Selenium.) Jean-Michel Dunoyer. *Comptes Rendus,* v. 226, May 10, 1948, p. 1524-1525.

The well-known red-gray transformation of selenium was studied. No physical or chemical method for transforming gray or vitreous selenium into the red form (amorphous) is known. Experiments reported show that a stable state of Se exists only below −80° C.

4c-56. Echange entre une lame de cuivre marqué par du radiocuivre at une solution d'ions cuivriques. (Exchange Between Copper Foil Tagged With Radioactive Copper and a Solution of Copper Ions.) Pierre Sue, Marguerite Quintin, and Marie Bizouard. *Comptes Rendus,* v. 226, May 24, 1948, p. 1723-1725.

The number of atomic layers or depth of the metal surface participating in the exchange varied from 500 to 17,000 depending on the method of preliminary surface preparation. The results should be of great value in metallography.

4d—Light Metals

4d-25. Deformation Characteristics of Magnesium. F. A. Fox. *Metal Treatment and Drop Forging,* v. 15, Summer 1948, p. 79-82.

Main principles underlying the deformation of the metal. 18 ref.

4d-26. Calciumsilizid als intermediärer Bestandteil in stranggegossenen Rundbarren aus einer Kolbenlegierung der Silumin-Gruppe. (Calcium Silicide as

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the first slag pot of the train. The air compressors are powered by the diesel locomotive. A simple switch in the locomotive cab tips the slag pots to empty into the pit. (see photograph on page 9.)

To haul molten iron from the blast furnaces to the bessemer converters at the Aliquippa Works of **Jones & Laughlin Steel Corp. (690)**, the company has installed 13 of the world's largest hot metal mixer cars. Designed and built by **M. H. Treadwell Co. (690)**, the cars are of 200 tons capacity as against the old style 25-ton open-top ladle cars.

Known as "submarine ladles" because of their shape, the cars are 53 ft. long from center to center of the couplings, and approximately 13 ft. high; weight is 115 tons. The ladle consists of a horizontal cylindrical middle section with conical ends to which trunnions are attached. Fireclay brick is used for a lining, with an expected life of 125,000 to 175,000 net tons.

Advantages include conservation of heat in the car, elimination of one reladling operation and omission of old-style mixers, and reduction in runner and ladle scrap.

Casting Methods

An important accomplishment of the year in the steelmaking industry was the perfection of a process for continuous casting of semifinished steel. As a joint project of **Republic Steel Corp. (691)** and **Babcock & Wilcox Tube Co. (692)**, experimental work had been under way for some years, but delivery of continuously cast steel for conversion into commercial products was not made until March of this year.

In the Babcock and Wilcox plant, steel is delivered from electric furnaces to an inductively heated holding and pouring ladle at the top of a 75-ft. tower. From there it is poured into a tundish, designed to strain out the slag, and thence into the mold. Below the mold, the casting passes through an insulated chamber which arrests and controls the speed of further cooling. Below this chamber is the withdrawal mechanism regulating the speed of movement of the steel billet. The casting then passes an oxy-acetylene torch which cuts it to specified length.

The greatest single advantage of the process, according to its sponsors, is that it removes from the conventional steelmaking process the most massive and expensive parts of the plant, such as equipment for ingots, soaking pits and the blooming mill. For the production of relatively small quantities of steel, and particularly as a means of decentralizing steel production, the new development fills the requirements of low capital and low operational costs.

New techniques for permanent mold centrifugal casting of alloy steels will be adopted by **Lebanon Steel Foundry (693)** with the acquisition of secret British processes on a licensing agreement with Firth-Vickers Stainless Steels, Ltd. The process will be put to use immediately in the production of turbojet components for military aircraft engines.

This so-called Centri-Die process was invented as the simplest method of manufacturing the circular and tubular components of the jet propulsion engine—rings, valves and sleeves enclosing the rotating turbine. Since the molten metal is deposited and solidified under high pressure in the mold, the resulting product has high density with excellent structural properties.

Although designed particularly for casting the newer high-temperature alloys, the process is applicable to many other alloys as well.

New Steels

Rycase is the trade name of an improved carbon-manganese carburizing steel distributed by **Joseph T. Ryerson & Son, Inc., (695)**. It has good machinability in addition to developing a hard, deep case with a rugged supporting structure. A bulletin gives chemistry, strength and recommended heat treatment.

Latrobe Electric Steel Co. (696) has commenced commercial production of a new line of high speed steels identified as the Electrite MV group. The line is distinguished by its chromium, molybdenum and vanadium content with no tungsten present. These steels are well adapted for applications which do not require the full properties of the more common tungsten and molybdenum-tungsten high speed steels, and are sold at a lower price. Recommended applications include small drills and reamers, thread chasers, taps, woodworking knives and cutters, and body stock for carbide-tipped drills and reamers.

Latrobe Electric is also manufacturing Desegatized brands of dispersed segregate die steels, claimed to possess an exceptionally high impact strength **(697)**. The Desegatizing process was first introduced by Latrobe in 1945 in the form of high speed toolsteels, but this year is the first time the process has been successfully applied to die steels.

In these steels the free carbides are evenly dispersed in the body of the steel, eliminating grouping together of carbides in a brittle central mass. Four high-carbon, high-chromium grades of die steels are being produced.

The relatively new A.I.S.I. 2800 plate steel (8½ to 9% nickel, low carbon) has received some exhaustive tests by **International Nickel Co. (698)** during the past year. Since the steel was developed primarily for engineering structures at low temperatures, welded pressure vessels were constructed and given severe impact tests at liquid nitrogen temperature (−320° F.). The nickel steel and 18-8 stainless steel vessels withstood 1500 ft.-lb. without damage, but carbon steel vessels cracked and broke at 1000 ft.-lb.

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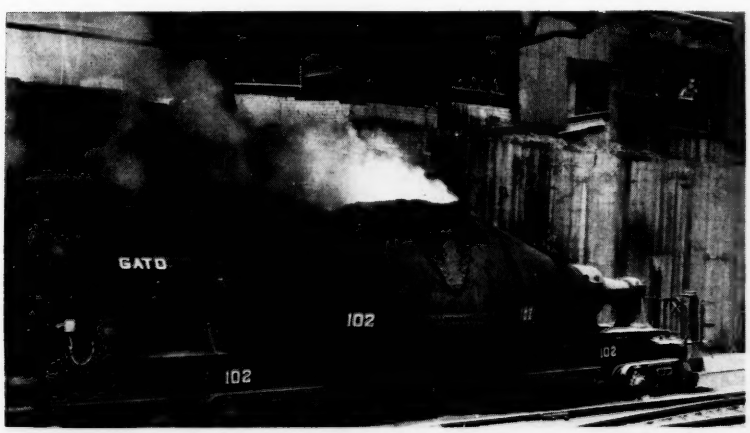

"Submarine Ladles"—One of Jones and Laughlin's 200-Ton Hot Metal Cars

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an Interstitial Constituent of Cast and Pressed Billets From a Piston Alloy of the Silumin Group.) H. Wolf. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 400-403.

In the above, the calcium silicide phase adversely affected the strength and corrosion properties of the metal. Its source was traced, and methods devised to eliminate it.

4d-27. Forme des cristaux et vitesse de croissance lors de la recristallisation de l'aluminium. (Crystal Form and Rate of Growth During Recrystallization of Aluminum.) W. G. Burgers. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 44, Nov.-Dec. 1947, p. 292-295.

Calls attention to certain peculiarities in the shape of the grain boundaries between aluminum crystals, which can be explained by differences in the rate of growth of adjacent crystals.

4d-28. The Effect of 1% Silicon on the Constitution of Aluminium-Magnesium-Manganese-Zinc Alloys at 460° C. H. J. Axon and W. Hume-Rothery. *Journal of the Institute of Metals,* v. 74, Feb. 1948, p. 315-329.

The constitution of Al-Mg-Mn-Zn-Si alloys containing 1% Si was determined for alloys containing 0 to 6% Mg, 0 to 4% Mn, and 0 to 8% Zn after annealing to equilibrium at 460° C. Results are presented graphically for alloys containing 1% Si; and 0, 4, and 8% Zn. 10 ref.

4d-29. Sur le comportement des joints de grains au cours du processus de fusion de l'aluminium tres pur. (Behavior of Grain Boundaries During Melting of Very Pure Aluminum.) Georges Chaudron, Paul Lacombe, and Nicolas Yannaquis. *Comptes Rendus,* v. 226, April 26, 1948, p. 1372-1373.

It was found that the metal forming the body of the grains has a slightly higher melting point than the metal in the grain boundaries.

4d-30. The Lattice Spacings of the Solid Solution of Copper in Aluminium. E. C. Ellwood and Jeanne M. Silcock. *Journal of the Institute of Metals,* v. 74, May 1948, p. 457-467.

Lattice spacings were determined by high-temperature X-ray measurements from 400 to 600° C. Microexamination and room-temperature X-ray measurements were used for comparison. The effect of equivalent atomic percentages of copper in distorting the aluminum lattice increases with increasing temperature, owing to the relatively greater differences in the atomic radius of the two elements caused by the difference in thermal expansion. The coefficient of thermal expansion decreases with increasing Cu content. 15 ref.

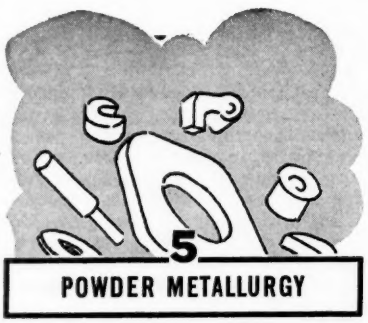
4d-31. Etude aux rayons X de la texture fine de cristaux d'aluminium. (X-Ray Study of the Fine Structure of Aluminum Crystals.) André Guinier and Jacques Tennevin. *Comptes Rendus,* v. 226, May 10, 1948, p. 1530-1532.

Results of study using a method which permits observation of imperfections not apparent by the Laue method. Monocrystals of aluminum subjected to various treatments were examined.

4d-32. A Note on the Aluminium-Manganese G Phase. K. Little and W. Hume-Rothery. *Journal of the Institute of Metals,* v. 74, June 1948, p. 521-524.

Previous work has shown the existence of a metastable phase, denoted G, in Al-rich alloys of Al and Mn made from high-purity metals and annealed at low temperatures. Debye-Scherrer films of this phase were taken and measured. A survey was made of the effects of Si, Fe, Co, Ni, Cu, Mg, Zn, and Cr on the stability of the G phase in Al-Mn alloys.

For additional annotations indexed in other sections, see: 3a-90; 3d-43-44; 18b-126; 19a-186-194.



5a—General

5a-49. Powder Metallurgy. Report of the International Symposium at Graz. *Metal Industry,* v. 73, Aug. 6, 1948, p. 103-105; Aug. 13, 1948, p. 129-130.

Reviews papers presented at the first international symposium of powder metallurgy held in Graz, Austria, on July 12-17.

5a-50. Powder Metallurgy. Alden M. Burghardt. *Journal of Chemical Education,* v. 25, Sept. 1948, p. 517-520.

Surveys processes and applications.

5a-51. Cermets, Ceramic-Metal Compounds. *Ceramic Industry,* v. 51, Sept. 1948, p. 108.

New ceramic-metal compounds that give promise as a material for use in jet engines and rockets. They include not only oxides and metal combinations, but mixtures such as oxides, carbides, nitrides, borides, and silicates on the one hand, and metals and alloys on the other.

5a-52. Le microscope électronique et la métallurgie des poudres. (The Electron Microscope and Powder Metallurgy.) Pierre Grivet and others. *Revue de Métallurgie,* v. 45, Jan.-Feb. 1948, p. 38-48.

Methods and applications. 11 ref.

5a-53. Préparation des poudres métalliques par électrolyse ignée. (Preparation of Metallic Powders by Fused-Salt Electrolysis.) J. L. Andrieux. *Revue de Métallurgie,* v. 45, Jan.-Feb. 1948, p. 49-59.

Details of method and its advantages and disadvantages. The most important disadvantage is the difficulty of separation of the powders from the melt. However, the method made it possible to obtain a series of pure powdered metals which could not be obtained in any other way.

5a-54. First International Powder Metallurgy Conference. *Metallurgia,* v. 38, Aug. 1948, p. 227-230.

Summarizes papers presented at conference in Graz, Austria.

5b—Ferrous

5b-29. Time and Temperature Effects in the Sintering of Iron Powders. Hans Bernstorff. *Metal Treatment and Drop Forging,* v. 15, Summer 1948, p. 85-89.

Some experimental studies made in the Degussa laboratories on the sintering of DPG-Schleuder iron powder. Tensile properties were determined after up to 10 hrs., sintering at 850 to 1300° C. 12 ref.

5b-30. Powdered-Iron Electrodes. I. Influence of Degree of Dispersion and of Composition of the Iron Powder on the Properties of Iron Electrodes. (In Russian.) L. L. Kuz'min and L. V. Borisova. *Zhurnal Prikladnoi Khimii.* (Journal of Applied Chemistry), v. 21, April 1948, p. 378-388.

Properties of iron electrodes depending on method of production of the powder by hydrogen reduction of iron oxide. 21 ref.

5c—Nonferrous

5c-24. Nonferrous Metal Powders. D. C. Bradley. *Product Engineering,* v. 19, Sept. 1948, p. 102-104.

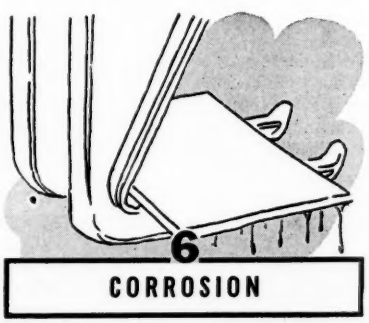
Physical properties of brass, copper, zinc, and bronze powders made by the atomization process; and the effect of phosphorus on brass powders. How sintering conditions affect parts.

5d—Light Metals

5d-3. A Study of Process Variables in the Production of Aluminium Powder by Atomization. J. S. Thompson. *Journal of the Institute of Metals,* v. 74, Nov. 1947, p. 101-132.

Results of a study of the effects of certain variables upon the most important characteristics of the product and the method of operation. Particular attention is paid to the rate at which atomization proceeds, the size grading of the powder, and the ease and efficiency of operation. A general explanation of the mechanism of operation is outlined and a tentative equation developed to cover the dependence of rate of atomization upon the most important variables. Determination of the size distribution of the powder of subsieve size. 11 ref.

For additional annotations indexed in other sections, see: 27b-37.



6a—General

6a-95. The Electrochemical Theory of the Solution of Metals in Acids. IV. (In Russian.) Ya. V. Durdin. *Zhurnal Obshchei Khimii.* (Journal of General Chemistry), v. 18 (80), March 1948, p. 345-363.

Details of a theoretical, mathematical analysis of the cathodic and anodic processes and their relative influences on the interaction of metals with acids. 17 ref.

6a-96. Les etats de surface et les propriétés physicochimiques réeles des métaux. (The Surface States and the True Physicochemical Properties of Metals.) Georges Chaudron. *Revue de Métallurgie,* v. 45, March-April 1948. p. 61-67.

The rate of attack of corrosive

(Turn to page 16)

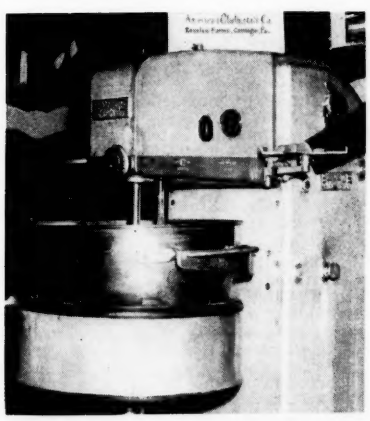
STEEL PLANT EQUIPMENT

The 9% nickel steel has been found suitable for a wide variety of applications at normal as well as low temperatures, and is being produced commercially in the form of billets and bars, plate, seamless tubing and forgings, flanged and dished heads, thin-gage strip, and welded tubing as small as ⅝-in. o.d. with 0.050-in. wall thickness.

Nonporous, dirt-free stainless steel castings are being produced by **Waukesha Foundry Co. (700).** These castings are free-machining, and are held to such close tolerances that rough machining operations can be reduced to a minimum.

As a result of a new process pioneered by **Cold Metal Products Co. (701),** bright annealed, cold rolled strip is now available in the 18-8 analysis. The steel can be furnished in dead-soft annealed temper and in a bright, mirror finish that does away with expensive buffing or polishing. Rolling with special tungsten carbide rolls accounts for the bright finish, which is retained during the annealing operation by a new technique, according to the manufacturers. This new product is being offered in widths up to 7½ in. and in thicknesses of 0.001 in. and heavier. It can be furnished in coils weighing up to 300 lb. per in. of width.

Rosslyn Metal is the new name of a stainless-clad copper manufactured by **American Cladmetals Co.** under the Kinney process **(702).** Pure copper is sandwiched between layers of stainless steel and permanently bonded together. The inner layer of copper conducts heat swiftly and evenly to all parts of the metal, while the corrosion resistant stainless steel surfaces impart the durability and ease of cleaning that copper lacks. Food processing equipment, restaurant and kitchen utensils are some of the many uses for the metal.



Food or Candy Mixing Kettle Made of Rosslyn Metal for Savage Bros.

A high-carbon steel wire with a tensile strength of 460,000 psi. in 0.010 gage, has been perfected this year by **American Steel and Wire Co. (703),** primarily for use in tenor banjos and guitars. The new "A" string, which gives a higher range to these instruments than formerly possible, is produced by a program of exceptionally long and exacting cold work, together with special heat treatments. The new wire, strongest of its size known today, will withstand a vibration load of 37.7 lb. as against the 32 to 34-lb. load of the previous "A" strings.

Equipment in the Mill

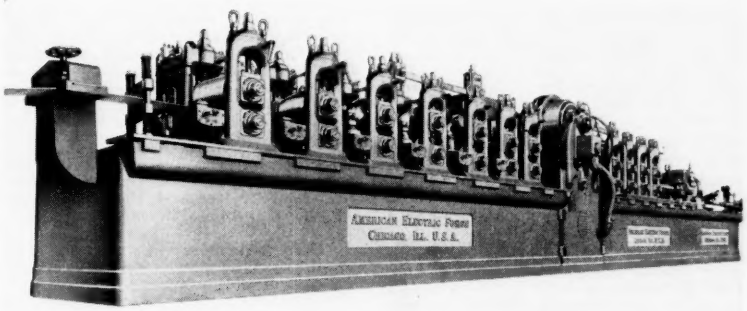
A new packaged amplidyne control unit for speed, current or voltage regulation in the steel mill has been announced by **General Electric Co. (704).** All the adjusting rheostats, capacitors, rectifiers, and instruments required for the amplidyne regulating circuit are brought together in a well-ventilated sheet steel enclosure, 18x12x11 in. in dimensions.

The control uses small rheostats in place of conventional resistor units. In addition to normal regulating functions, it also provides motor speed limit control, field forcing during acceleration and deceleration, and stabilizing functions.

National Tube Co.'s No. 2 seamless pipe mill at Gary, Ind. **(705),** recently modernized and rebuilt, will be served by a huge new "doughnut-type" rotary heating furnace and a new 13-unit reheating furnace. The mill will turn out tubes from 3 to 9 in. in outside diameter and up to 45 ft. long.

The new rotary heating furnace is the only one of its kind in the country having a many as five separate heating zones. The circular kiln has an outside diameter of 61 ft. and an inside radius of 19 ft. Temperatures in each heating zone can be controlled independently of the temperatures in the other zones.

A mill for converting strip into standard weight pipe with diameter sizes ranging from ½ to 2 in. has been developed by **American Electric Fusion Corp. (706).** The mill transforms coils of flat strip into electrically welded pipe at speeds up to 65 ft. per min., depending on diameter. The pipe is formed, welded, scarfed, sized, straightened and cut to length in one continuous automatic operation. Because of the small amount of labor required to operate the mill, pipe in the ½ to 2-in. diameter range can be produced with a low capital investment and a low operating cost per foot.



Automatic Welded Pipe Mill—American Electric Fusion Corp.

Sheet, Strip and Wire

The new Talbot type flying sheet shear recently introduced by **United Engineering and Foundry Co. (708)** is basically a guillotine shear, but differs from conventional types in the conception of its knife path motion. In the Talbot motion, the bottom knife pitmans are mounted on eccentrics integral with a planet pinion sleeve bushed on a main crank eccentric. It is driven by a planet ring gear in timed relationship to the top knife main shear frame, which is in turn eccentrically mounted on the main crankshaft. Number of miscuts is varied by miscut change gears driven from the main crankshaft.

Speed synchronization can be adjusted to permit fingertip matching of knife speed with strip feed speed at will, with shear either in motion or at rest. The shear will cut lengths

(*Turn to page* 17)

media on metals depends primarily on the nature of the oxide film and secondarily on the structure of the upper layer of metal. However, investigations showed that other factors are involved (effect of which have not as yet been fully established) which may be of even greater importance in the physicochemical behavior of metals. 11 ref.

6a-97. The Mechanism of the Formation of Films on Metals. U. R. Evans. *Corrosion and Material Protection,* v. 5, July-Aug. 1948, p. 15-19.

In 1943, Vernon discussed the laws governing the formation of oxide films, or other layers, on a metallic surface, and concluded that good experimental evidence exists for four growth-laws; parabolic, rectilinear, logarithmic, and asymptotic. The present author has shown that, by considering the alternative manners in which films might be expected to grow, these four laws are readily deducted. The arguments are condensed into a single, short and relatively nonmathematical statement. 35 ref.

6a-98. Petroleum Rust Preventives. Albert E. Hickel. *Petroleum Refiner,* v. 27, Aug. 1948, p. 94-96.

Various grades available now for practical application; condition and length of service are big factors to consider in corrosion of metals.

6a-99. Causes of Steel Corrosion. Ivor Richards. *Organic Finishing,* v. 9, Aug. 1948, p. 41-46.

A textbook-type discussion of the theory of corrosion and factors which cause it.

6a-100. Inhibiting Corrosion in Packaged Goods. *Electroplating,* v. 1, Aug. 1948, p. 533-534.

A newly-patented method of preventing corrosion during transport and storage.

6a-101. Preventing Galvanic Corrosion. H. Seymour. *Mining Magazine,* v. 79, Aug. 1948, p. 84-87.

Cathodic protection of piping.

6a-102. Surface Reactions. *Metal Industry,* v. 73, Aug. 6, 1948, p. 106.

Discusses various recent papers on oxide films on metals and alloys.

6a-103. Temperature and Humidity Factors in the Corrosion of Metals in a Sulphur Dioxide Atmosphere. (In Russian.) O. V. Zarubina and M. L. Turich. *Zhurnal Prikladnoi Khimii.* (Journal of Applied Chemistry), v. 21, April 1948, p. 362-371.

In the temperature range between 15 and 40° C., at any value of the relative humidity, the main factor in the corrosion of metal surfaces in an SO_2 atmosphere was found to be the temperature. The maximum corrosion was observed from 20 to 25° C., at a relative humidity of 80% or more. Metals or alloys tested were soft iron, cast iron, aluminum, sheet iron, nickel steel, copper, and brass.

6a-104. Considérations sur la passivité des métaux. (Theories Concerning the Passivity of Metals.) R. Piontelli. *Métaux & Corrosion,* v. 23, May 1948, p. 124-135; discussion, p. 134.

Results of a theoretical study of the above, including effects of a series of pertinent factors. Phenomena should be studied from thermodynamic, kinetic, and structural points of view.

6a-105. Atmospheric Corrosion Testing Site. Arba H. Thomas. *Corrosion,* v. 4, Sept. 1948, p. 456 and special section, p. 1.

Five-acre outdoor laboratory of Armco Steel Corp., Middletown, Ohio.

6a-106. Management Information on Cathodic Protection of Buried Metallic Structures Against Corrosion. *Corrosion,* v. 4, Sept. 1948, special section, p. 3-5.

Bulletin I prepared by the Correlating Committee on Cathodic Protection, National Association of Corrosion Engineers.

6a-107. Application of Electron Diffraction Techniques to the Study of Corrosion Processes. E. A. Gulbransen. *Corrosion,* v. 4, Sept. 1948, p. 445-455.

Pertains primarily to the study of the dry-oxidation reaction. Discusses particularly the corrosion of iron and of an alloy of Fe, Ni, and Cr. Principles and operation of the electron microscope and methods of its use for above type of problem.

6b—Ferrous

6b-97. Fissuration de l'acier doux par corrosion sous contrainte. (Stress Corrosion Cracking of Mild Steel.) J. T. Waber and H. J. McDonald. *Revue de Métallurgie,* v. 45, March-April 1948, p. 93-104.

Previous theories and a theory according to which it is caused by the continuous and combined action of precipitation and stress in accordance with a definite cycle. An important result deduced from the theory is that dissolved nitrogen is responsible for the cracking of steel. 79 ref.

6b-98. Measurement of Galvanic Currents Around an Underground Structure. N. P. Peifer and F. E. Costanzo. *Corrosion and Material Protection,* v. 5, July-Aug. 1948, p. 4-14.

Determinations of the location and intensity of the anodic and cathodic areas on the surface of an underground pipe were made by three different methods: the copper sulphate half-cell electrode, a steel-tipped bar inserted close to the pipe surface, and an earth-current meter. Results show wide variation and indicate that discharge from the pipe varies although potentials remain the same.

6b-99. Cathodic Protection of Steel Water Tanks. Peter E. Pallo, *Water & Sewage Works,* v. 95, Aug. 1948, p. 293-297.

An investigation designed to determine the degree of protection obtained in bare steel tanks provided with an aluminum anode, with an applied external potential, a galvanic magnesium anode without applied potential, and the electrodeless circuit with an applied external potential. A fourth tank, used as a control, was afforded no protection.

6b-100. Corrosion Problems of Offshore Structures. Elton Sterrett. *World Oil,* v. 128, Sept. 1948, p. 84.

Problems and preventive methods.

6b-101. Magnesium Anodes for Pipe Line Protection. D. J. Walraven. *World Oil,* v. 128, Sept. 1948, p. 182, 184, 186.

Use of prepacked combinations of Mg anodes and backfill material to reduce the amount of materials and speed up installation. A suitable backfill surrounding the anode is necessary to improve efficiency and prolong life.

6b-102. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 40, Sept. 1948, p. 105A-106A. Based on report by T. E. Larson, Illinois State Water Survey, Urbana, Ill.

How cathodic protection with magnesium anodes prevented severe underwater corrosion of hot-water tanks.

6b-103. Corrosion intergranulaire des aciers inoxydables austénitiques coulés. (Intergranular Corrosion of Austenitic Stainless Cast Steels.) H. A. Pray. *Revue de Métallurgie,* v. 45, Jan.-Feb. 1948, p. 19-31; discussion, p. 31.

Experimental work for Alloy Castings Institute at Battelle Memorial Institute. Intergranular attack in cast alloys of the 19% Cr, 9% Ni type is caused by precipitation of carbides in the primary grain boundaries. Appearance of precipitates in the ferritic phase in a number of the alloys studied did not cause sensitivity to intergranular attack. 18 ref.

6b-104. Contribution a l'étude de la corrosion intercristalline de l'acier par les nitrates. (Contribution to the Study of the Intergranular Corrosion of Steel by Nitrates.) Michel Smialowsky. *Revue de Métallurgie,* v. 45, Jan.-Feb. 1948, p. 32-37.

Results of a study of the action of ammonium and sodium nitrates plus a series of additives on low-carbon steels. Experimental apparatus and method.

6b-105. Corrosion of Iron and Steel; Atmospheric Protection and Marine Fouling. *Metallurgia,* v. 38, Aug. 1948, p. 201-206.

Summaries of papers on protection against atmospheric corrosion, anti-fouling compositions, and cementiferous paints, and accompanying discussion at a recent meeting of the Iron and Steel Institute and the British Iron and Steel Research Association.

6b-106. Action of Rust-Preventive Oils. E. R. Barnum, R. G. Larsen, and A. Wachter. *Corrosion,* v. 4, Sept. 1948, p. 423-431.

Results of certain experiments, including details of apparatus and procedure. A mechanism for the protective action of oil solutions of polar compounds on steel. 12 ref.

6c—Nonferrous

6c-30. Influence de la texture et de l'orientation cristalline sur l'aptitude a l'oxydation seche du cuivre et du fer. (Effect of Structure and Crystal Orientation on the Tendency Toward Dry Oxidation of Copper and Iron.) Jacques Benard and Jean Talbot. *Revue de Métallurgie,* v. 45, March-April 1948, p. 78-85; discussion, p. 85.

Results of a study at about 900°. Effect of rolling, of deformation by stretching, and of crystal orientation on the structure of the oxide layer; and effects of surface state (prepared by electropolishing and by different forms of abrasion) on the course of the oxidation. 11 ref.

6c-31. Influence of Impurities in Lead-Antimony Alloys on Plate Performance of Storage Batteries. (In Russian.) V. P. Mashovets and A. Z. Lyandres. *Zhurnal Prikladnoi Khimii.* (Journal of Applied Chemistry.), v. 21, April 1948, p. 347-361.

Influences of Ag, Bi, As, Fe, Zn, Cu, Ni, Co, Sb, and Mg on chemical stability of 6%-Sb lead alloys. 28 ref.

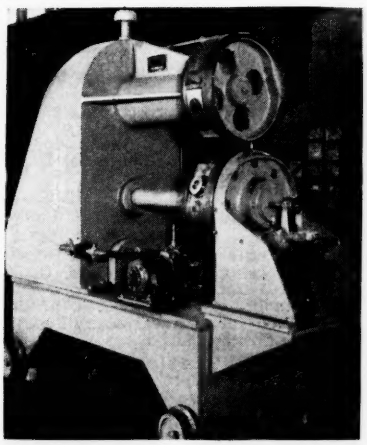
6c-32. Prevention of Corrosion in Lead-Sheathed Cables by Means of a Vulcanized Protective Covering. B. B. Reinitz and N. A. Zamborsky. *Corrosion,* v. 4, Sept. 1948, p. 432-444; discussion, p. 444.

Methods for prevention of corrosion or damage caused by action of corrosive media, by galvanic action involving dissimilar metals, by scoring during installation, and by stray and other currents in the presence of an electrolyte. Test procedures include 6-year salt-solution immersion test; internal-pressure bursting test; and manhole bend test. 13 ref.

(Turn to page 18)

varying from 30 in. to 36 ft. at speeds up to 600 or 700 ft. per min.

United Engineering and Foundry Co. has also built a drum-type sample punch **(709)** designed to cut samples up to 4 in. in diameter out of steel strip 0.005 to 0.020 in. thick, running at speeds up to 2000 ft. per min. Similar machines are in the design stage to cut samples from strip up to 0.036 in. thick at speeds approaching 4000 ft. per min.



Flying Sample Punch With Front Guards Removed, ShowingDrums and Solenoid Controlling Punch Action

Installed in such applications as cold mills or electrolytic tinning lines, the flying punch is used to take samples on the fly for rapid determination of physical properties or coating characteristics.

The punch consists essentially of two geared drums driven by a d.c. motor; it is at all times exactly synchronized with the movement of the strip. Extension and retraction of the punch is controlled by an actuating button. Samples may be taken at any point across the width of the strip, or fixed, as desired.

In the wire mill, use of a recently developed phosphate rust inhibitor known as Banox **(Calgon, Inc.—710)** has increased the speed of drawing fine high-carbon wire as much as 20 to 25%. The first application of the material in wiredrawing has been at Jones & Laughlin Steel Corp.'s Aliquippa mill, where damage to dies and wire has likewise been reduced.

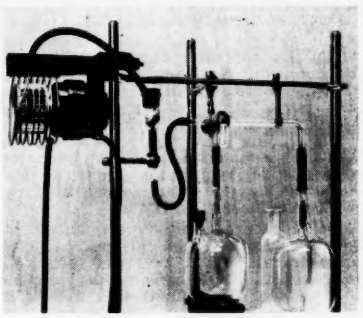
Coils of wire are dipped successively in an 8 to 10% sulphuric acid pickle, a water rinse, a 1% Banox solution for 4 min., water rinse, and a bath of 8 to 9% hydrated lime. After drawing in a flash baker, the wire is ready for reduction on Vaughn wet drawing machines from diameters of 0.028 to 0.066 in. to a finished size of 0.007 in. The Banox film not only inhibits rust but also helps to lubricate the wire in process, and reduces the amount of lime necessary.

The Steel Plant Laboratory

For sampling molten steel at temperatures in the neighborhood of 2700° F. **General Electric Co.** has developed a simple but effective "eyedropper" technique **(712)**. The eyedropper is a heat resistant glass tube, about the diameter of a lead pencil and 18 in. long, with a rubber bulb at one end. Liquid steel is drawn into the tube by squeezing the rubber bulb. In 5 min. the steel has hardened into a smooth, homogeneous rod, the glass is cracked away from it and the rod is ready for testing.

Eye-dropper samples may be prepared for analysis in a few minutes, as against long hours for older techniques, involving such laborious operations as cutting a block from a hardened steel mass, machining it into a rod, and buffing to high polish.

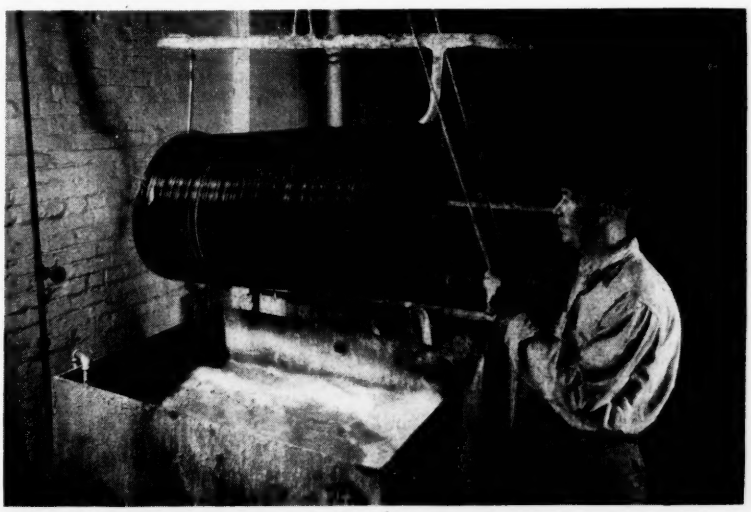
A gas cooler to be used in conjunction with a volumetric carbon determinator is a new accessory recently marketed by **Harry W. Dietert Co. (713)**. The carbon determinator itself tends to operate at room temperature, while the incoming gas from the combustion furnace is above room temperature. Since the volume of gas is to be measured (in order to determine the percentage of carbon in the sample), it must be maintained at a specific temperature.



Gas Cooler for Carbon Determinator—Harry W. Dietert Co.

The gas cooler consists of a coil of fine-diameter stainless steel tubing, through which the gas is passed. The tubing is in a field of air current from a blower fan connected to an electric motor. The incoming gases are thus brought to the same temperature as the volume-measuring parts of the carbon determinator.

Fully automatic equipment for measuring the per cent of oxygen in flue gases provides a means for checking combustion conditions in the openhearth. Released for sale by **Leeds & Northrup Co. (714)**, Micromax oxygen recorders operate on the thermal conductivity principle. Analysis for oxygen is by the sensitive and accurate hydrogen difference method, which consists of adding hydrogen to the gas sample, removing oxygen by combustion, and electrically comparing the conductivity of the sample before and after oxygen is removed.



Cleaning Line for High-Carbon Wire Including Banox Dip

For Bulletins and Further Information, Use Reader Service Coupon on Page 53

6d—Light Metals

6d-30. La corrosion intercristalline de l'aluminium de haute pureté et ses conséquences au sujet de la nature des joints de grains. (Intercrystalline Corrosion of High-Purity Aluminum as Influenced by the Nature of the Grain Boundaries.) Paul Lacombe and Nicolas Yannaquis. *Revue de Métallurgie,* v. 45, March-April 1948, p. 68-76; discussion, p. 76-77.

Literature and experimental results. Both chemical and electro chemical attack were investigated. The usual explanation based on the presence of impurities is not valid for very pure aluminum. The amount of attack varies in accordance with grain-boundary contour, which can be explained on the basis of more or less void volume. 17 ref.

6d-31. Sur l'oxydation de l'aluminium a basse température. (Oxidation of Aluminum at Low Temperatures.) N. Cabrera. *Revue de Métallurgie,* v. 45, March-April 1948, p. 86-92.

A theory of oxidation at low temperatures and results of experiments mostly at room temperature, but also a few at temperatures up to 450° C., in which very thin films of Al, prepared by vacuum deposition on glass, were exposed to dry oxygen, dry ozone, ultraviolet irradiation, moist air, and moist oxidation. Optical factors of the films (transmission and reflection) were measured before and after exposure, as these have a direct relationship to the degree of oxidation. The method is not satisfactory at elevated temperatures. 14 ref.

6d-32. Stress-Corrosion Tests on High-Strength Aluminum Alloy Sheet. Hugh L. Logan and Harold Hessing. *Journal of Research of the National Bureau of Standards,* v. 41, July 1948, p. 69-85.

The materials were exposed unstressed and stressed in tension to three-quarters of the yield strength in a sodium chloride hydrogen peroxide solution and in a marine atmosphere. 13 ref.

6d-33. Aluminium-Zinc-Magnesium Alloys. Types of Alloys—Results of Tropical Exposure Tests. *Metal Industry,* v. 73, Aug. 20, 1948, p. 152-153. Based on recent B.I.O.S. report.

Results of wartime German research on four different alloys containing over 90% Al.

6d-34. Recent Developments in Corrosion-Resistant Aluminium-Magnesium Alloys. P. Brenner. *Journal of the Institute of Metals,* v. 74, Dec. 1947, p. 159-190.

Influence of chemical composition and thermal treatment on the intercrystalline corrosion of Al-Mg alloys containing 5-9% Mg. A new method of heat treatment is suggested in which the alloy is cooled very slowly from the homogenizing temperature at about 50° C. per hr. Tests and service trials indicate that alloys treated by this method are immune to intercrystalline-corrosion and stress-corrosion failure even at the high temperatures encountered under tropical conditions. 35 ref.

6d-35. Examination of Aluminium Conductor Cables After 15-25 Years' Service. J. Herenguel. *Metallurgia,* v. 38, Aug. 1948, p. 244. Translated and condensed from *Revue de l'Aluminium,* Dec. 1947, p. 357-360; March 1948, p. 73-78.

Results of examination show generally very good condition. A satisfactory lifetime of 50 years is estimated.

For additional annotations indexed in other sections, see: 3a-95; 3d-44; 27a-129.

7 CLEANING and FINISHING

7a—General

7a-184. The Adsorbed Layer as a Passivating Factor. (In Russian.) G. S. Koshurnikov. *Zhurnal Obshchei Khimii,* (Journal of General Chemistry) v. 18, (80), March 1948, p. 388-397.

Adsorption of phenol from aqueous solution onto Fe, Zn, Fe_2O_3, and Al_2O_3 was investigated. Surface layers resulting from the adsorption are irreversible, indicating that the character of the reaction is chemical and possesses a certain thermal and chemical stability against weak acids. This stability may be "fixed" by condensation with formaldehyde or urotropine.

7a-185. Nickel Plating by Chemical Reduction. J. G. M. Bremner. *Nature,* v. 162, July 31, 1948, p. 183-184.

Proposed mechanism for the method described by A. Brenner and Riddell.

7a-186. Two-Tone Finish on Metal. John Raine. *Industrial Finishing,* v. 24, Aug. 1948, p. 48-50, 52, 54.

Method of producing a diffused and hammered effect by a single spraying with a special spray gun which receives ground and accent colors from two heated tanks.

7a-187. Metal Surface Preparation for Organic Coatings. (Concluded). A. Gellman. *Electroplating,* v. 1, Aug. 1948, p. 511-520, 530-531.

The value of metal surface preparation before painting and the way in which it is performed on sheet steel, aluminum, and zinc.

7a-188. How Metallizing Is Used for the Maintenance of the Modern Press. Rick Mansell. *Modern Industrial Press,* v. 10, Aug. 1948, p. 6, 8, 46.

Examples and techniques.

7a-189. The Mechanism of Action of Metal Protective Paints. A. C. Elm. *Paint, Oil and Chemical Review,* v. 111, Aug. 19, 1948, p. 16, 32-34, 36, 38.

Principles employed in formulation of metal protective paints.

7a-190. New Baby in the Fluorine Family. *Industrial and Engineering Chemistry,* v. 40, Sept. 1948, p. 22A, 24A.

Properties and potential applications of a number of salts of fluorophosphoric acid, recently made available in experimental quantities. Applications suggested include cleaning of metals, as electrolytic or chemical polishing agents, or in formation of protective coatings on metals, as well as in organic and physiological chemistry.

7a-191. Recent Developments in Synthetic Resins for Protective Coatings. L. R. Whiting. *Paint and Varnish Production Manager,* v. 28, Sept. 1948, p. 266-272.

Previously abstracted from *American Paint Journal,* v. 32, April 19, 1948, p. 72, 74, 76-79, 82. See item 7a-91, 1948.

7a-192. Blast Cleaning Prepares Surfaces for Finishing. L. J. Wieschhaus. *American Machinist,* v. 92, Sept. 9, 1948, p. 81-84.

Process as applied to various products.

7a-193. Mechanical Finishing With Roto-Finish Techniques. Arthur P. Schulze. *Plating,* v. 35, Sept. 1948, p. 911-916.

Particular characteristics of Roto-Finish techniques. Sizable savings are now being obtained where this method is used.

7a-194. Approximate Tables to Use for Drawing Up Hot Dip Galvanizing Pot Specifications. Part 1. Wallace G. Imhoff. *Industrial Gas,* v. 27, Aug. 1948, p. 9-12, 23.

Practical set of figures that can be used as a guide for production, metal capacity, size of pot, and side thickness of pot. (To be continued.)

7a-195. Finishing Clinic. Allen G. Gray. *Products Finishing,* v. 12, Sept. 1948, p. 76, 78, 80, 82, 84, 88, 90, 92, 94, 96.

Importance of passivation in surface finishing of stainless steel; proper control for production of consistently high-quality wrinkle finishes; d.c. power transmission in the plating room; and pointers in buffing aluminum.

7b—Ferrous

7b-162. Flame Cleans Rails to Prevent "Freezing" of Joint Bars. U. F. Portell. *Railway Engineering and Maintenance,* v. 44, Sept. 1948, p. 925.

Method for removal of mill scale, rust and moisture.

7b-163. Conditions in the Pickling Bath Which Affect Hydrogen Embrittlement. C. A. Zapffe and M. E. Haslem. *Wire and Wire Products,* v. 23, Sept. 1948, p. 753-761, 792, 793.

Test procedure, and results of investigation of effect of acid type and concentration, of temperature, of promoters and of inhibitors. Under the latter heading, effect of six commercial pickling inhibitors for stainless steel were studied.

7b-164. High Production Galvanizing of Small Parts. Walter Rudolph. *Metal Finishing,* v. 46, Sept. 1948, p. 62-63, 67.

Equipment and methods.

7b-165. Electrostatic Descaling for High-Speed Production. Arthur P. Schulze. *Production Engineering & Management,* v. 22, Sept. 1948, p. 67-71.

Use of the Bullard-Dunn process for scale and oxide removal from ferrous parts on a volume production basis.

7b-166. Layout of Porcelain Enameling Department: Lustron Corp. *Ceramic Industry,* v. 51, Sept. 1948, p. 68-70.

Also brief description of enamel preparation and application and list of suppliers for the department.

7b-167. Continuous Strip Pickling. Part II. Edwin D. Martin. *Blast Furnace and Steel Plant,* v. 36, Sept. 1948, p. 1089-1094.

Previously abstracted from *American Iron and Steel Institute Preprint.* 1948. See item 7b-116, 1948.

7b-168. Gas Convection Heating Cures Automotive Finishes at Briggs Manufacturing Co. II. Arthur Q. Smith. *Industrial Heating,* v. 15, Sept. 1948, p. 1557-1558, 1560, 1562, 1564.

Oven requirements for paint drying; air heaters; spray-paint booths, each equipped to apply 18 separate colors; polishing rooms; general statistics; and the results obtained with the heating equipment described in this and the preceding article.

(Turn to page 20)

Important Physical Characteristics of Steel

The Second of Three Practical Lectures on the Working of Steel, Written by Chester M. Inman for the Worcester Chapter A.S.M.

IN THE FIRST lecture in this series of three (July *Metals Review*, page 3) we endeavored to paint a mental picture of the mechanical nature of steel structures obtained by various heat treatments. We found that steel is fundamentally a crystalline alloy, mainly composed of iron with a small amount of carbon to give it hardening properties. We found that the basic structure—alterable by heat treatment—consists of a variable grain size and a hard carbide of variable fineness with either a lamellar or globular formation within a matrix of ferrite.

Under consideration were the straight carbon or "pearlitic" type of steels. Most of the alloy steels also are of the "pearlitic" type and react to heat treatment in exactly the same manner as do the straight carbon steels. The pearlitic steels tend to form lamellar pearlite upon normal air cooling, and to harden upon quenching at a fast rate. With such changes taking place within the steel, concurrent changes in the physical properties of the steel are to be expected, especially with the introduction of other alloying elements.

Briefly, in the standard pearlitic steels, alloying elements serve mainly to enhance the fundamental properties already existing in a straight carbon steel. We shall find that unless the alloy steels are ultimately to be used in the hardened and tempered condition, the alloys themselves possess no magical qualities, and do not warrant the extra price or extra machining expense.

In the use and working of steel, it is important to understand the effect of alloys and the meaning of the physical properties. One should know which physical properties are changed by heat treatment and which remain the same irrespective of material analysis or heat treatment.

The mechanical structures or microstructures of alloy steels do not change fundamentally from the structures described for carbon steels. The action of the alloying elements depends upon various tendencies:

1. A tendency to unite with the iron and carbon to form complex carbides which, under heat treatment, act in the same manner as the iron carbide in the formation of mechanical structures.

2. A tendency to unite with the iron in a solid solution, thereby increasing the strength or toughness of the ferritic matrix. This means that the ferrite (the low-temperature form of iron) acts as a solvent, particularly for the ferrite-strengthening elements.

3. A tendency to increase hardenability (depth of hardness).

Carbon is the most important element used in iron. This is especially true of the structural types of pearlitic steels whose relatively low alloy content would be of little advantage except for the presence of carbon. Carbon is the only alloy that produces the potential quality of hardness; at the same time it also promotes brittleness. Since carbon promotes depth of hardness (hardenability) of a fully hardened martensitic structure only to a limited degree, the use of carbon steels for maximum strength is restricted to the smaller sections.

The main effect of the alloying elements when dissolved in austenite is to increase this depth hardening power. The amount necessary for equal depth of hardness varies with the particular alloy.

Vanadium, molybdenum, tungsten, and chromium have strong carbide-forming tendencies, tend to promote a fine-grained steel, to increase the wear resistance, and to raise the tempering temperature at which similar physical properties are developed. These carbide-forming elements are useful in toolsteels to increase wear resistance, both at low and at high operating temperatures. This latter quality is well illustrated by high speed steel, which retains its hardness far above the point at which carbon steels become too soft as a cutting tool.

Manganese, silicon, and nickel form a solid solution with the ferritic matrix and have practically no value in restricting grain growth. Manganese and silicon harden the ferrite with some loss of plasticity, and moderately increase the hardenability. Manganese over 1% shows a marked increase in hardenability. Nickel strengthens and toughens the ferrite, and for this reason nickel steels are somewhat more difficult to machine to a good finish. Nickel also mildly increases hardenability.

Laboratory tests have proven that it is the carbon content and not the alloy content of the steel that controls the hardness of a fully hardened martensitic structure. Irrespective of the alloy or its percentage, the potential hardness of a 0.20% carbon steel is Rockwell C-40 to 45, and of a 0.50% carbon steel is Rockwell C-60 to 65. (These high Rockwell readings were produced on small pieces by special quenches and cannot be duplicated in commercial work.)

Fundamentally, then, two of the major requirements in the chemical analysis of a steel specification are carbon content for control of the degree of hardness, and alloy content for the control of depth of hardness (hardenability).

In connection with such a specification, the development of the National Emergency Steels during the war brought emphatically to the users' attention two important facts:

1. That a small amount of two or more alloys gives better physical properties than a greater amount of a single alloy, since one intensifies the effect of the other.

2. That for the great majority of structural requirements demanding tensile strength under 200,000 psi., the kind of alloys used makes no difference so long as the required hardenability is achieved.

Tests reported in the A.S.M. Metals Handbook prove that "the S.A.E. structural steels are substantially equivalent on the basis of mechanical properties as determined by the tensile test under the following conditions:

"1. If the sections are so chosen that the test pieces of each steel are hardened throughout on quenching.

"2. If the test pieces are tempered to the same tensile strength, irrespective of the tempering temperature necessary to produce that strength.

"3. If a tensile strength of 200,000 psi. is not exceeded."

It should be carefully noted that the conditions outlined refer only to results obtained by the tensile test, and for practical use should be qualified as follows: first, that the carbon content of a substitute steel is not greatly in excess of the original steel, and second that the steel is being used at normal working temperatures and not at very high or very low temperatures.

The foregoing illustrations are only a few examples of the similarity be-

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7c—Nonferrous

7c-34. Pre-Treatments for Galvanized Iron Prior to Painting. Rick Mansell. *Organic Finishing,* v. 9, Aug. 1948, p. 38-40.

Various methods, including weathering, mechanical sanding, blasting, and wire brushing; acid etching; plating, and deposition of inorganic films such as sodium silicate.

7c-35. Die Castings Must Be Clean. III. A Compendium of Cleaning Cycles Proved in Present-Day Production Practice. Arthur P. Schulze. *Products Finishing,* v. 12, Sept. 1948, p. 40, 42, 44, 46, 50, 52, 54, 58, 60.

16 references.

7d—Light Metals

7d-39. The Influence of Sealing Treatments on the Protective Value of Anodized Coatings. L. Whitby. *Metal Finishing,* v. 46, Sept. 1948, p. 70-74.

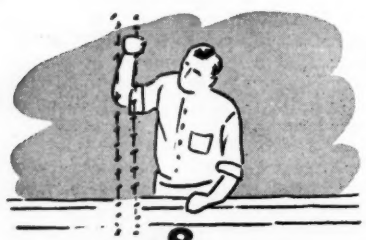
Previously abstracted from *Metal Industry,* v. 72, May 14, 1948, p. 400-403. See item 7d-27, 1948.

7d-40. Aluminum Alloy Castings. (Continued.) Floyd A. Lewis. *Foundry,* v. 76, Sept. 1948, p. 90-93, 212, 214, 216, 218, 220.

Recommended practices in cleaning and finishing aluminum alloy castings.

For additional annotations indexed in other sections, see:

6c-32; 22a-184.



8

ELECTRODEPOSITION and ELECTROFINISHING

8-188. Uber die elektrolytische Herstellung von Bleibronzelagern. (Electroforming of Lead-Bronze Bearings.) A. Beerwald and L. Dohler. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 412-417.

Experimental process and equipment, using alkaline tartrate and citrate baths. Critically evaluates the prospects of the process.

8-189. Anodicka oxydace hliniku a jeho slitin. (Anodic Oxidation of Aluminum and Its Alloys.) Jan Kaloc. *Hutnické Listy,* v. 3, April-May 1948, p. 135-143.

Most important methods for the above and the properties of the resulting layers. Results of comparative tests using different alloys in contact with chromic, sulphuric, and oxalic acids, also various additions and conditions.

8-190. Touring a Silver Plating Plant. A. A. Parsons. *Electroplating,* v. 1, Aug. 1948, p. 488-494, 530.

Author takes reader on an imaginative tour of a medium-sized silver-plating shop commenting on the plant, solutions and processes employed in the light of his experience.

8-191. Notes on Modern Nickel and Chromium Plating Practice. N. Christie. *Electroplating,* v. 1, Aug. 1948, p. 495-501; discussion, p. 501-503.

Certain rules for bright and heavy nickel and chromium-plating techniques. Suggestions for reducing costs.

8-192. Pyrophosphate Copper Plating. *Electroplating,* v. 1, Aug. 1948, p. 523-526, 534.

Development of pyrophosphate solutions for the electrodeposition of copper as described by American and Russian workers. The latest development points to the value of nitrate additions in effecting an all-round improvement.

8-193. Continuous Gas-Radiant Fusion for Electrolytic Tinning. C. E. Cunningham. *Iron and Steel Engineer,* v. 25, Aug. 1948, p. 85-92.

The inverse-square law for radiation effect offers a rapid and accurate method of controlling the amount of heat to be transmitted particularly in a continuous processing line.

8-194. Plating Bath Troubles. (Concluded.) H. J. Sedusky and J. B. Mohler. *Metal Industry,* v. 73, Aug. 13, 1948, p. 126-128.

Remedies for common electrodeposition faults.

8-195. Periodic Reverse Plating; Better Deposits at Greater Speeds. G. W. Jernstedt. *Metal Industry,* v. 73, Aug. 27, 1948, p. 171-173. (A condensation.)

Previously abstracted from *Plating,* v. 35, July 1948, p. 708-713. See item 8-172, 1948.

8-196. Advantages of Chromium Plating. *Steel,* v. 123, Aug. 30, 1948, p. 56-57.

A review of characteristics. Process reduces adhesion and wear, thereby more than justifying its cost in many applications.

8-197. Fluid Mechanics: Forgotten Factor in Electroplating. Part IV. Joseph B. Kushner. *Metal Finishing,* v. 46, Sept. 1948, p. 52-58.

The cathode film and the relative effects of various methods of solution agitation on the limiting current densities that can be used for electroplating.

8-198. Design of Plating Range Cells. J. B. Mohler. *Metal Finishing,* v. 46, Sept. 1948, p. 59-61.

The factors that affect design of plating cells for solution control and how special cells provide more accurate information than standard cells in some cases.

8-199. Determination of p-Toluenesulfonamide in Nickel Plating Baths. Julius Sirota. *Metal Finishing,* v. 46, Sept. 1948, p. 68-69.

The method makes use of the chlorination of p-toluenesulphonamide to p-toluenesulphonedichloramide. The amide is then solvent extracted, dissolved in acetic acid and excess KI solution, and titrated with sodium thiosulphate, using starch as an indicator.

8-200. Surface Areas of Standard Machine Screws. *Metal Finishing,* v. 46, Sept. 1948, p. 77.

A table for use in barrel plating computations on commercial machine screws.

8-201. Process Sheet for Copper Plating. George Black. *American Machinist,* v. 92, Sept. 9, 1948, p. 139.

8-202. Notes on Filtration in a Modern Plating Plant. G. M. Cole. *Plating,* v. 35, Sept. 1948, p. 904-909.

A schematic drawing of a modern filtration system and some of the features of filtration in practice today.

8-203. Porosity of Electrodeposited Metals. III. Measurement of Intrinsic Porosity. (Concluded). *Plating,* v. 35, Sept. 1948, p. 917-920, 967.

The measurement of one particular kind of porosity only, which the authors call intrinsic or systematic porosity. This kind of porosity is present in perfect deposits free from gross pores caused by base metal imperfections, dirt in the plating solution, and the like.

8-204. Plating Bath Troubles. H. J. Sedusky and J. B. Mohler. *Canadian Metals & Metallurgical Industries,* v. 11, Aug. 1948, p. 23-24, 38.

Previously abstracted from *Metal Industry,* v. 73, July 30, 1948, p. 91-93; Aug. 13, 1948, p. 126-128. See items 8-186 and 8-194, 1948.

8-205. Contributo allo studio della elettrodeposizione di leghe—Nota IV. (Contribution to the Study of the Electrodeposition of Alloys. Part IV.) Roberto Piontelli. *La Metallurgia Italiana,* v. 40, Jan.-Feb. 1948, p. 3-8.

After a general review of the theory of electrodeposition of alloys as compared to the electrodeposition of pure metals, methods for electrodeposition of alloys using fused-salt baths are described. Composition and structure of deposits.

8-206. Contributo allo studio della elettrodeposizione di leghe—La constituzione dei prodotti. (Contribution to the Study of the Electrodeposition of Alloys—Constitution of the Products.) Vincenzo Montoro. *La Metallurgia Italiana,* v. 40, Jan.-Feb. 1948, p. 9-12.

The electrodeposition of Ni-Co, Cu-Sn, and Cu-Pb alloys. It was found that primary solid solutions, intermediate phases, and mixtures more or less closely associated with one of the alloy components are present. 14 ref.

8-207. Chemical Stability of Tin Coatings. (In Russian.) N. N. Gratsianskii and P. F. Kalynzhnaya. *Zhurnal Prikladnoi Khimii.* (Journal of Applied Chemistry), v. 21, April 1948, p. 341-346.

Physical and chemical characteristics of electroplated tin coatings from various baths, especially stannate and sulphuric acid, were studied, and factors influencing their chemical stability are indicated.

8-208. Sur la théorie du polissage anodique. (Theory of Anodic Polishing.) Jean Mercadié. *Comptes Rendus,* v. 226, May 10, 1948, p. 1519-1520.

A new theory emphasizes that introduction of additional substances such as alcohols, anhydrides, etc., results in reduction of the dielectric constant, thus aiding formation of the complexes required for polishing according to the theory proposed.

8-209. Electrodeposition of Gamma Manganese. David Schlain and John D. Prater. *Journal of the Electrochemical Society,* v. 94, Aug. 1948, p. 58-73.

Convenient procedures for deposition of electrolytic manganese in the flexible gamma form rather than the usual brittle alpha form. Excellent deposits were obtained on copper cathodes at current efficiencies of 62 to 72%; deposits on stainless-steel cathodes were much poorer. 23 ref.

8-210. The Electrodeposition and Properties of Tin-Zinc Alloys. J. W. Cuthbertson and R. M. Angles. *Journal of the Electrochemical Society,* v. 94, Aug. 1948, p. 73-98.

Details of experimental results obtained by the Tin Research Institute (England) since 1946, when a summary of prior work was published. Details of some early exploratory work not hitherto published and some conclusions which have been modified as a result of recent observations.

8-211. Control of Electroplating Solutions by Analysis and Observation. III. Sampling of Solutions and a Scheme for Regular Analyses. K. E. Langford.

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tween carbon and alloy steels. Generally, it may be stated that alloying elements are useful to control the reaction rates of the decomposition of austenite (the change from the high-temperature to the low-temperature form of iron) and the formation of carbides, but the alloys have no value for strengtheners as such.

These tests show the marked similarity between the physical properties of all steels—both straight carbon and alloy—under definite, controlled conditions. Actually these conditions are such as to establish similar mechanical microstructures in the steel. The first condition calls for the establishment of a fully martensitic structure throughout the entire piece, with no transformation to a weaker structure taking place during the quench. The second condition means that different tempering temperatures are necessary, dependent upon the alloy content, for the sufficient dispersion of spheroidal carbides within the matrix to correspond to the desired tensile strength. The third condition limits the tensile strength to a mechanical microstructure within what might be considered the useful plastic range of the steel. With tensile strengths over 200,000 psi., the steel may be considered to be in the brittle range.

Selection of Steels

Now that we have shown that the physical strength of steel depends upon the mechanical structure developed, and that fundamentally this structure is the same for all carbon and alloy steels, a few comments on the selection of steel are in order. For steels other than toolsteels (where wear resistance plays such an important part), two things should be considered: First, how much carbon is necessary to obtain the required hardness (bearing in mind that as the carbon content of the steel increases so does the brittleness) and second, how much alloy is required to produce the desired hardenability—that is, depth of hardness. As a general rule, for structural parts a combination which will allow a tempering temperature of about 950 to 1150° F. is desirable.

These two facts may be expressed in another way: If a carbon steel will do the job, an alloy steel is not necessary; and because a little alloy is required, it does not hold true that more of the same alloy or alloys is better. However, it may be beneficial to use more alloys if by so doing a less drastic quench may be used, with consequently less internal stress, or if a higher tempering temperature may be used for relief of internal stresses. Specification of alloy steels is not warranted unless they are ultimately to be used in the hardened and tempered condition so as to develop the beneficial effects of the alloying elements.

To summarize the effect of alloys, we find they impart to the pearlitic type steels when used in the hardened and tempered condition:

1. Greater strength in large sections.
2. Greater hardness and strength at elevated temperatures.
3. Less distortion in the quenching process (slower quenches).
4. Greater resistance to abrasion at the same hardness (with the carbide-forming elements as alloys).
5. Higher toughness at the same hardness (by permitting a lower carbon content, the use of ferrite toughners, and higher tempering temperatures).

In the application of steel to industrial parts one of the main requirements is physical strength. While the true value of any part lies in its actual life under service conditions, it is not always practicable to test new material or designs under actual operating conditions. For this reason a number of standard tests have been developed to establish the relationships between the various physical characteristics of the steel.

The small, uniform and well-machined sections used in all standard tests do not give exact information as to the actual properties of the finished part. The size, shape of section, the surface condition, and the residual stresses remaining in the piece from heat treatment may cause the actual part to have only a small percentage of the strength one might expect from the results of the standard tests. This means that standard test results, being only of the material itself under definite conditions, are generally not fully representative of the physical properties of the entire design. Moreover, the results of most tests are generally indicative of a trend rather than the establishment of definite relations.

For instance, the various impact tests, which are an endeavor to work out a measure of toughness, are an example of the trend class of tests that do not give any directly usable information. There exists no comparison between the different impact tests, and even in the same method of testing there is no relationship or meaning to the results obtained that can be used in design. Such results simply show a preference for one steel, under the conditions of the test, but there is no way of determining the actual value of one steel over the other under actual operating conditions. In this lecture we shall confine ourselves to the discussion of known facts that have a practical application to the working of steel.

Without doubt the tensile test gives the most directly usable information for engineering design. The tensile test, which consists of pulling a standard test specimen to destruction, well illustrates a number of interesting properties of steel, some of which are commonly misunderstood. As we load or stress the test specimen, we find that, for each definite amount of loading, a certain definite stretch or strain is obtained up to a certain point, generally called the elastic limit, after which the material starts to yield and deforms permanently. This plastic deformation hardens the material so that some further increase in the load is necessary to break the specimen. The maximum load withstood up to fracture gives the tensile strength.

Between the elastic limit and the ultimate tensile strength of the steel there is a range where plastic deformation takes place, that is, where the steel is capable of deforming to a certain extent without fracturing. This plastic range is utilized in cold drawing and cold forming operations. Low-carbon steels are much used for cold work, since, with little carbide in the matrix they have a low elastic limit in relationship to their ultimate strength, therefore, plastic deformation may take place in a considerable range. The plastic deformation in cold drawing of low-carbon steels raises the elastic limit by workhardening, and tends to promote better machining qualities.

In the tensile test the plastic deformation range is represented by the per cent elongation and per cent reduction of area. While these results are somewhat indicative of a difference between brittle and ductile material, no definite conclusions can be reached for direct comparison. Most engineers believe that, with 10% elongation in a 2-in. gage length, the steel has sufficient plasticity for the great majority of purposes. While a high value for the reduction of area is assumed to show good toughness, a reduction of area of slightly over 35% will meet a 180° cold bend test irrespective of whether the per cent elongation is high or low.

The elastic limit and ultimate or tensile strength of the steel are indicative of some very interesting properties that provide definite information. With the elastic limit, steel is an elastic material—that is, it stretches or contracts the definite amount of 0.001 in. per in. of length for each 30,000 psi. of loading or unloading. Surprising at first thought is the fact that the amount of stretch (called strain) is identical up to the elastic limit of either a weak or a strong material, irrespective of the chemical analysis or whether the steel is hardened or annealed. However, since we have shown that steel is mainly iron, this unchangeable

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Electroplating, v. 1, Aug. 1948, p. 504-507.

Solutions and methods of sampling. (To be continued.)

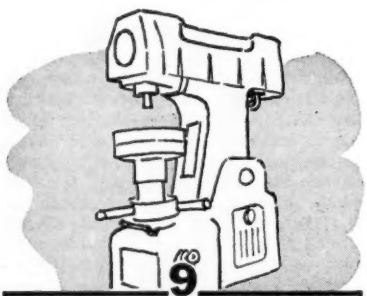
8-212. Embrittlement of Roller Chains by Plating After Assembly. *Product Engineering*, v. 19, Sept. 1948, p. 105.

Hazards incurred when assembled precision steel roller transmission chains are electroplated. Reasons why plating of assembled steel roller chain sometimes causes failure of bushings and sideplates.

8-213. Evaluation of Strip Plating Aided by Use of Circulating Electrolyte Cell. R. A. Dimon. *Steel*, v. 123, Sept. 20, 1948, p. 116, 118, 121, 124.

Apparatus developed to duplicate in the laboratory as closely as possible conditions existing in a commercial installation.

For additional annotations indexed in other sections, see:
11-218; 22a-184.



PHYSICAL and MECHANICAL TESTING

9a—General

9a-68. The Measurement of the Damping Capacity of Metals in Torsional Vibration. G. A. Cottell, K. M. Entwistle, and F. C. Thompson. *Journal of the Institute of Metals*, v. 74, March 1948, p. 373-417.

The cause of the discrepancy between the results of "mechanical" and "physical" methods of measuring damping capacity in torsional vibration was investigated. In a machine of the Föppl-Pertz type the energy loss in the machine itself may, when testing a material of low damping capacity, amount to about 500 or more times the intrinsic energy dissipation of the specimen. All the major sources of loss have been isolated, and complete redesign of an existing machine has reduced the measured damping to twice the lowest values measured by the physical method.

9a-69. The Estimation of Specific Damping Capacity From Measurements of Experimental Decay Curves. G. L. J. Bailey. *Journal of the Institute of Metals*, v. 74, March 1948, p. 417-424.

This article is an appendix to the one preceding it. (See above abstract.) A method for treating experimental decay curves is proposed and explained which permits estimation of specific damping capacity at any measured amplitude within calculable limits of error.

9a-70. Micro-Hardness Testing of Metals. E. Wilfred Taylor. *Journal of the Institute of Metals*, v. 74, June 1948, p. 493-500.

When an indenter is used, the impressions made are usually large in relation to the microstructure of the specimen. Desirability of a form of hardness test which can be applied to a particular crystal or to a small selected area, and the factors controlling the application of very light loads to a diamond indenter. A new micro-hardness tester having the above characteristics is described.

9a-71. Discussion of the Forces Acting in Tension Impact Tests of Materials. D. S. Clark and P. E. Duwez. *Journal of Applied Mechanics*, v. 15. *(Transactions of the American Society of Mechanical Engineers*, v. 70), Sept. 1948, p. 243-247.

A method for measuring the forces acting on a specimen during a tension-impact test. The method of computing force-time relations in a specimen subjected to tension impact from the standpoint of the theory of the propagation of elastic and plastic strain. The method was applied to a specimen of S.A.E. 1020 cold rolled steel to illustrate the procedure. 11 ref.

9a-72. A Method of Making High-Speed Compression Tests on Small Copper Cylinders. E. T. Habib. *Journal of Applied Mechanics*, v. 15. *(Transactions of The American Society of Mechanical Engineers*, v. 70), Sept. 1948, p. 248-255.

In mechanical gages used to measure the pressure from an underwater explosion, small copper cylinders are compressed at high speeds. Test apparatus designed for dynamic calibration of these cylinders and results obtained.

9b—Ferrous

9b-46. Rate of Propagation of Fatigue Cracks in 12 by 3/4-In. Steel Plates With Severe Geometrical Stress-Raisers. Wilbur M. Wilson and James L. Burke. *Welding Journal*, v. 27, Aug. 1948, p. 405s-408s.

Object of the tests is to determine to what extent the rate of propagation of fatigue cracks in plates is related to Charpy notch impact value of the steel. A comparison was made of the relative effect of fatigue cracks and jeweler's saw cuts on rate of propagation of fatigue cracks.

9b-47. Flexural Fatigue Strength of Steel Beams. Wilbur M. Wilson. *Welding Journal*, v. 27, Aug. 1948, p. 409s-417s.

The stringers of through bridges and beams of short beam-spans are subjected to a large number of stress cycles, and the dead load stress found to be very small. The principal purpose of the investigation is to determine relative fatigue strengths of various kinds of flexural members.

9b-48. Tensile and Elasticity Testing of Steel Roller Chain. *Product Engineering*, v. 19, Sept. 1948, p. 121.

Design of grip jaws and procedure for testing standard steel roller chain as recommended by the Association of Roller and Silent Chain Manufacturers.

9b-49. The Influence of the Dimensional Factors on the Mode of Yielding and Fracture in Medium-Carbon Steel. I. The Geometry and Size of the Flat Tensile Bar. Julius Miklowitz. *Journal of Applied Mechanics*, v. 15. *(Transactions of the American Society of Mechanical Engineers*, v. 70), Sept. 1948, p. 274-287.

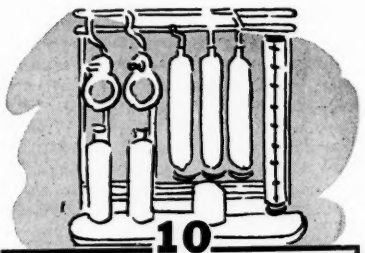
Results of a detailed study of the local principal strains, during uniform straining in a flat tension bar, which has proved valuable in explaining the observed large variations of the local necking strains with uniform changes in geometry and size of the bar. Analogy between the restraining action of the bar heads on the gage material, and that of the neck material on the flowing material adjacent to it. 18 ref.

9c—Nonferrous

9c-2. Pressure and Creep Tests at Constant Hoop Stress on Lead and Alloy "E" Pipes. A. Latin. *Journal of the Institute of Metals*, v. 74, Jan. 1948, p. 259-289.

A method of testing lead and lead-alloy pipes at constant hoop stress, necessitating pressure adjustments. From the results, the Andrade creep constants considered to represent two different types of creep flow were determined. Some consideration is given to the nature of creep flow, and a hypothesis is developed to account for the results. Applications to some problems connected with the use of lead sheath for high-voltage pressure cables. 32 ref.

For additional annotations indexed in other sections, see:
3a-90-99; 3b-140; 3c-67; 3d-44; 24a-200.



ANALYSIS

10a—General

10a-64. L'etat actuel de la polarographie. Une revue bibliographique des annees 1941-1947. (Present Status of Polarography. A Review of the Literature for the Years 1941-1947.) Paul Delahay. *Analytica Chimica Acta*, v. 2, Feb. 1948, p. 60-73.

241 references.

10a-65. Titrimétrie des ions céreux par le permanganate. (Titrimetric Determination of Cerous Ions by Permanganate.) G. Goffart. *Analytica Chimica Acta*, v. 2, April 1948, p. 140-145.

Direct titration method for the above in nearly neutral pyrophosphate solution. The reaction was studied both potentiometrically and amperometrically. The latter method yields the best results and permits use of a particularly simple and practical device. The only interfering element is manganese.

10a-66. Correction for Gamma Changes Due to Variations in Exposure and Development With Reference to Spectrographic Analysis. (Two Line-Pair Method.) C. Sanders. *Journal of the Society of Chemical Industry*, v. 67, May 1948, p. 185-187.

The procedure was found useful in the spectrographic determination of composition by the method in which the log ratio of deflection is plotted against per cent content (or log per cent content), no intensity calibration being carried out. Essentially the procedure consists of using two line pairs for each determination, one on the positive

(Turn to page 24)

property is not now so surprising. This definite property is called the modulus of elasticity, and is a measurement of the ability of steel to resist elastic deformation; that is, it is a measure of true stiffness. It has no relation to the strength of the steel or to its elastic limit. One of the reasons for the usefulness of steel is that it is one of the stiffest of materials, being twice as stiff as brass and three times as stiff as aluminum.

A common shop misconception that one steel is stiffer than another is due to the fact that the steel with the higher elastic limit will resist taking a permanent set to a greater degree. Actually, all steels are equally stiff in identical sections; that is, a soft steel that does not bend by taking a permanent set under a load. will not deflect more than a fully hardened steel under the same load. If less deflection for the same design of section under a certain load is desired, a larger size must be used. In other words, the stiffness or rigidity of a structure depends upon the size and shape of the section along with the modulus of elasticity of the material used, and not upon the strength of the material.

While the elastic limit is a direct indication of the limit for usable static stress, the direct use of tensile strength values is rare. (Exceptions are explosive shells and protective devices such as shear pins.) In the great majority of parts, the life of the part is important and not the failure.

Tensile strength and the various indentation hardness tests are measurements of essentially the same properties. Conversion tables have been worked out which closely approximate the relation between the methods of testing. At low hardness values they do not show the working characteristics of the composite structure of the steel although the hardness values may be the same for different structures.

The tensile strength of the steel does play a very important part, indirectly, in the life of those structural parts which fail from fatigue —commonly but erroneously known as "crystallization" in the shop. Probably most of you have heard of or have seen fractures that have been attributed to "crystallization" of the steel—the fracture shows some smooth areas and others of a crystalline nature. Actually the part is broken by a progressive fracture, properly called a fatigue failure. The smooth areas are those portions where rubbing has taken place, and when the remaining area was not sufficient to carry the load the steel pulled apart causing the rough area. Each so-called crystal in the fracture is composed of many grains of the original crystalline structure of the steel.

Under the ideal conditions of the test specimen, with its small size and highly polished, uniform section, the fatigue limit of steel under reverse stresses has been found to be approximately 50% of the tensile strength. This value of fatigue limit is always below the value of the elastic limit of the steel, but has no relation to it. This means that with a heat treated steel having a tensile strength of 140,000 psi. you would have an elastic limit of 125,000 psi. usable for a static stress, but only 70,000 psi. usable under reverse stresses such as found in revolving shafts. Actually, this fatigue limit value of 50% of the tensile strength is greatly reduced by what is known as stress raisers.

In fact, under severe stress raisers, such as a sharp circular notch, mill scale, or corrosion, nothing is to be gained by using steels with a tensile strength greater than about 125,000 psi. (approximately Brinell 255, Rockwell C-25).

Fatigue failures are caused by progressive fractures, starting almost without exception from surface imperfections or sharp changes in section. Among these surface imperfections, called stress raisers, are mill scale, decarburized skin, corrosion, tool marks, and rough machining. Sharp changes in section without large and smooth fillets, threaded sections, and keyways, tend to build up localized stresses both in the heat treatment of the part and under working conditions. Special note should be taken of the fact that these stress raisers emphasize localized stresses in hardening even to the extent of actual breakage. In any event, even after tempering of hardened steel, stress raisers promote residual stresses which cannot be calculated and which may be just short of the breaking point of the steel.

J. O. Almen of General Motors has made the statement, "Of all fatigue failures occurring in service or during laboratory and road test, 40% are traceable to design and 50% to production defects. Only the remaining 10% are primarily the responsibility of the metallurgist, as defects in material (which almost never give any trouble), or heat treatment."

The most important fact to be gleaned from these lectures is that good workmanship on the surface of all parts, both before and after heat treatment, will do more to give satisfactory life of the part than can be accomplished by any change in steel, change in heat treatment, and possibly change in design.

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and the other on the negative side of log ratio 0.000.

10a-67. A New Method of Photographic Evaluation of Spectrographic Analysis. A. Argyle and W. John Price. *Journal of the Society of Chemical Industry,* v. 67, May 1948, p. 187-190.

A simple nomographical method for evaluation of minor constituents, which, provided that the density values all fall on the straight line portion of the H. & D. curve of the emulsion used, is independent of gamma variation. The nomograph not only corrects for changes in gamma across one plate, but also from plate to plate of any type.

10a-68. Une nouvelle technique de microdosage iodométrique du fer. (A New Technique for Iodometric Microdetermination of Iron.) L. Deibner. *Bulletin de la Société Chimique de France,* May-June 1948, p. 615-629.

Extensive details of a micro modification of the Mohr-Braun method, including a review of the literature on iodometric determination of iron. Effects of various factors on the accuracy of the determination. 40 ref.

10a-69. Quelques dosages semiquantitatifs basés sur l'emploi de réactifs sensibles et sélectifs. (Some Semiquantitative Determinations Based on the Use of Sensitive and Selective Reagents.) Paul E. Wenger and D. Monnier. *Bulletin de la Société Chimique de France,* May-June 1948, p. 517-520.

General analytical method. Three or four reagents which are selective for the element being considered are chosen and their limits of detection are determined. Tables and formulas are then prepared which permit calculation or estimation of the approximate amount of the element present from observation of several factors. The method is illustrated by several examples including analysis of copper, chromium, and nickel in alloys.

10a-70. Erreur résultant de l'usage d'un condensateur d' amortissement lors des enregistrements polarographiques. (Error Resulting From the Use of a Damping Condenser During Polarographic Recording.) Paul Delahay. *Bulletin de la Société Chimique de France,* May-June 1948, p. 527-528.

There is an error of the order of 0.005 to 0.010 volt in the half-wave potential under the above conditions.

10a-71. Application of Methylviolet in Quantitative Analysis. Determination of Cadmium. (In Russian.) M. A. Popov. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry) v. 3, May-June, 1948, p. 167-171.

Method applicable to separation of Cd from the principal minerals in which it is found. The Cd is determined colorimetrically in the form of the sulphate. The method permits determination of 0.5% Cd in a 5g. sample, and is said to be adapted to routine analysis. 11 ref.

10a-72. The Flame Photometer. R. Bowling Barnes, John W. Berry, and Wilbur B. Hill. *Engineering and Mining Journal,* v. 149, Sept. 1948, p. 92-94.

Apparatus and its use for instantaneous and continuous assay of ore-dressing mill pulps.

10a-73. Reaction of Ferrous and Ferric Iron With 1, 10-Phenanthroline. I. Dissociation Constants of Ferrous and Ferric Phenanthroline. T. S. Lee, I. M. Kolthoff, and D. L. Leussing. *Journal of the American Chemical Society,* v. 70, July 1948, p. 2348-2352.

Above reaction is used extensively for the colorimetric determination of iron and as an oxidation-reduction indicator. Results of a study of dissociation constants and of the effects of acid on them. 10 ref.

10b—Ferrous

10b-56. Accumulation of Traces of Arsenate by Coprecipitation With Magnesuim Ammonium Phosphate. I. M. Kolthoff and C. W. Carr. *Analytical Chemistry,* v. 20, Aug. 13, 1948, p. 728-730.

By quantitative coprecipitation 0.075 mg. of arsenic dissolved in 500 ml. of solution can be determined with an accuracy of 2%. Metal ions that are precipitated in ammoniacal medium are made harmless by the addition of an excess of tartrate. The method can be applied to the determination of arsenic in steel that contains more than 0.01% of arsenic.

10b-57. Simple Tests or Identifying Cast Irons. *Welding Engineer,* v. 33, Sept. 1948, p. 67.

Information is given in tabular form.

10b-58. Estimation of Molybdenum in Iron and Steel; A Rapid Method Using a Simple Photometer. E. J. Ronnie. *Metallurgia,* v. 38, Aug. 1948, p. 235-236.

10b-59. Analyzing Malleable Iron; A Rapid Method for Cr, Si, and Mn Determinations. W. B. Sobers. *American Foundryman,* v. 14, Sept. 1948, p. 56-58.

Details of combined method. Si is determined gravimetrically; Mn, volumetrically; Cr, colorimetrically. Cu, Ni, Mo, and P can also be determined colorimetrically on aliquot parts of the master solution. Heat treatment and decarburization were found to have no effect on the analysis and distribution of Cr. in malleable iron.

10c—Nonferrous

10c-69. Un dosage colorimétrique du cuivre. (Colorimetric Determination of Copper.) D. Monnier, I. Pardova, and P. E. Wenger. *Analytica Chimica Acta,* v. 2, Feb. 1948, p. 30-35.

Method is based on the solution of anhydrous Cu_2Cl_2 in potassium thiocyanate in acetone, followed by spectrophotometric measurement of the intensity of color of the red complex formed.

10c-70. Colorimetric Determination of Copper With the Aid of Dimethylglyoxime. (In Russian.) V. M. Peshkova, M. E. Lebontin, and K. I. Litein. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 3, May-June 1948, p. 161-166.

The methods of Goethals and of Clarke and Jones were studied. Certain modifications of the latter were developed, resulting in more stable coloration. The nature of the reaction was studied.

10c-71. Nioxime—A Reagent for Nickel. Roger C. Voter, Charles V. Banks, and Harvey Diehl. *U. S. Atomic Energy Commission,* MDDC-985, May 29, 1947, 8 pages.

Procedure for the gravimetric determination of nickel and palladium with the compound 1. 2-cyclohexanedionedioxime which is similar to dimethylglyoxime.

10c-72. Colorimetric Determination of Copper With Carbon Disulfide and Diethanolamine. Warren C. Woelfel. *Analytical Chemistry,* v. 20, Aug. 13, 1948, p. 722-724.

A reagent prepared from carbon disulphide and diethanolamine reacts with the cupric ion to form a brownish-yellow salt of bis (2-hydroxyethyl) dithiocarbamic acid. The reaction has been made the basis of a colorimetric method for the determination of copper.

10c-73. Determination of Lead in Air. L. J. Snyder, W. R. Barnes, and J. V. Tokos. *Analytical Chemistry,* v. 20, Aug. 13, 1948, p. 772-776.

To aid in rapidly detecting and avoiding dangerous concentrations of tetraethyl lead in air, a field micro-method was developed, which requires approximately 10 min. and is accurate to better than 1 microgram of lead per cu. ft. of air.

10c-74. Dosage entierement automatique de quelques alliages d'argent et de cuivre. (Completely Automatic Analysis of Certain Alloys, of Silver and Copper.) Simonne Peltier and Clement Duval. *Comptes Rendus,* v. 226, May 24, 1948, p. 1727-1729.

How the Chevenard thermobalance may be used for quantitative analysis of the above, without weighing or separation of the constituents, by merely measuring two lines recorded on photographic paper.

10c-75. Polarographic Characteristics of +2 and +3 Vanadium. I. Polarography in Non-Complexing Solutions. James J. Lingane and Louis Meites. *Journal of the American Chemical Society,* v. 70, July 1948, p. 2525-2529.

Polarographic characteristics were studied in a wide variety of media, including dilute acids and alkalies, phosphate, acetate pyridine, and carbonate buffers, and solutions of the halides, thiocyanate, cyanide, thiosulphate, pyrophosphate, borate, benzoate, phthalate, salicylate, tartrate, and citrate. Only the cases in which no complex ions are formed.

10d—Light Metals

10d-21. Sur la thermogravimétric des précipités analytiques. V. Dosage du magnésium. VI. Dosage du glucinium (beryllium.). VII. Dosage du lithium. (Concerning the Gravimetric Behavior of Analytical Precipitates on Heating. V. Determination of Magnesium. VI. Determination of Glucinium (Beryllium). VII. Determination of Lithium.) Thérese Duval and Clément Duval. *Analytica Chimica Acta,* v. 2, Feb. 1948, p. 45-59.

In Part V, results of a study by means of the Chevenard thermobalance of a series of compounds which have been proposed for gravimetric analysis. In Part VI, the same apparatus was used for study of four beryllium compounds. Preference for the pyrophosphate is indicated. Also recommends heating to 951° only, instead of to 1200° C. In Part VII, four precipitates commonly used for lithium determination were studied. Temperatures recommended for heating each salt are given.

10d-22. On the Detection of Aluminum by Means of Aluminon (In English.) C. J. Van Nieuwenburg and G. Uitenbroek. *Analytica Chimica Acta,* v. 2, Feb. 1948, p. 88-91.

The reaction of aluminum with aluminon was modified in order to make it specific. This was accomplished by adding H_2SO_3 beforehand and C_2H_5OH and HCl afterwards. The first reagent prevents the interference of Cr, In, Ga, and Ti; the second that of Be, Sc, Zr, and small amounts of ferric iron.

10d-23. Sur la thermogravimétrie des précipités analytiques. VIII. Dosage du sodium. IX. Dosage de l' ammonium. X. Dosage du potassium. XI. Dosage du rubidium. (Concerning the Gravimetric Behavior of Analytical Precipitates on Heating. VIII. Determination of Sodium. IX. Determination of Ammonium. X. Determination

(Turn to page 26)

Howe Medal Awarded to J. W. Spretnak

[Bulletin—Announcement has just been received of Dr. Spretnak's appointment as associate professor of metallurgy at Ohio State University.]

Joseph W. Spretnak, a member of the staff of the Metals Research Laboratory, Carnegie Institute of Technology, has been awarded the Henry Marion Howe Medal of the American Society for Metals. The medal, which is given annually to the author of the paper of highest merit published in the A.S.M. *Transactions,* will be presented to Dr. Spretnak during the annual banquet of the American Society for Metals in Philadelphia on Oct. 28.

Still a comparative youngster (B. Sc. in Metallurgical Engineering, Ohio State University, 1938; M. Sc., Case Institute of Technology, 1940; Ph. D., University of Pittsburgh, 1948), Dr. Spretnak started writing prize-winning papers early in his career; in 1941 he was awarded the A.I.M.E. Graduate Student Paper Prize.

From 1940 to 1943 he was engaged in research on steel melting and general ferrous physical metallurgy in the research department of the National Malleable and Steel Castings Co. in Cleveland. Since 1943 he has been carrying on research at Carnegie Institute of Technology on alloy steel ingots, properties of forging steels, and quench cracking in steel forgings, sponsored by the National Defense Research Committee and subsequently by Army Ordnance.

The Howe Medal paper presents the results of a portion of this work and is one of a series of published reports. Under the title "Kinetics of Solidification of Killed Steel Ingots", it was published in v. 39 of the A.S.M. *Transactions.*

Tinius Olsen in New Plant

Tinius Olsen Testing Machine Co. of Philadelphia has moved to a new plant adjacent to Philadelphia in Willow Grove, Pa. The plant has more than 100,000 sq. ft. of area all on one floor.

The Reviewing Stand

TWO YEARS AGO in response to a strong and persistent reader demand, *Metals Review* inaugurated the policy of printing its A.S.M. Review of Current Metal Literature on one side of the page only. This was done to facilitate clipping and filing of the literature annotations until such time as the thoroughly indexed bound volume should be available.

That was fine, but . . .

The Review of Metal Literature has grown to such a point that it occupies *all* of the left-hand pages of the entire book, and is continuing to grow at such a rate that it must of necessity spill over into the right-hand pages as well. Furthermore, information of permanent value also has to be printed on the right-hand pages. Readers want, for instance, to file the monthly surveys of important literature and products in specific fields; they want to use the convenient Reader Service Coupon without defacing the literature annotations on the reverse side.

After sitting uncomfortably on the horns of this dilemma for some time and being pricked periodically by letters lamenting the situation, the publishers of *Metals Review* have hit upon what would appear to be a satisfactory solution. That is to offer to members the opportunity to purchase a second copy at the nominal cost of $2.00 per year. (Uncle Sam gets around a similar situation by printing the Air Force's *Technical Data Digest* with one side of the page totally blank, but unfortunately we're not that well-heeled.)

Starting with the January issue, therefore, the Review of Metal Literature will be printed on succeeding pages using both sides of the page. If you want to clip the items for filing until such time as the annual bound volume is available, write for a second subscription starting with the January 1949 issue. In these days of soaring printing costs, the price of $2.00 barely covers postage, paper and handling.

Punch Card Filing Department

The need for simpler means for keeping up with the tremendous volume of scientific literature rolling from the world's presses (which is estimated to grow at the rate of 5% per year) was again brought forcefully to our attention by a recent report in *Chemical and Engineering News* of a two-week (no less) conference held in London earlier this year.

Known as the Royal Society Scientific Information Conference, it was divided into four sections for detailed consideration of (1) publishing and distributing original scientific papers, (2) issuing and using abstracts, (3) indexing and other library services, and (4) reviews and annual reports. The object of the conference was to "examine the entire field of communication in science with regard to quality, quantity, rapidity, availability, and cost of publication".

As this issue of *Metals Review* goes into the mails, a group of metallurgists and librarians will be assembling in Philadelphia for a meeting on classification of metallurgical literature and punch card filing. That this project is worthy of serious consideration is further borne out by another quotation:

"The conference observed that an improved classification, based either on the Universal Decimal Classification (British) or some other, will be needed to meet the widening interests of pure and applied science. It was recognized that both cumulative card indexes and volume-bound indexes are essential tools for the individual user and for librarians, and it was urged that easy and reasonably cheap means of converting from one to the other be developed."

We readily admit that finding such an improved classification and indexing system—even when limited to the field of metallurgy—is no mean task. But if it needs to be done, and will eventually enable us to improve the service offered by the A.S.M. Review of Current Metal Literature—let's make a start!

—M.R.H.

of Potassium. XI. Determination of Rubidium.) Thérese Duval and Clément Duval. *Analytica Chimica Acta,* v. 2, April 1948, p. 97-114.

Chevenard-thermobalance pyrolysis curves for series of compounds commonly used for gravimetric determination of the above ions. Recommendations for modifications of existing methods.

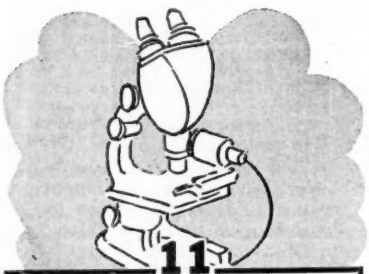
10d-24. Dosage des traces de gallium dans les bauxites et produits dérivés. (Determination of Traces of Gallium in Bauxites and Its Products.) S. Lacroix. *Analytica Chimica Acta,* v. 2, April 1948, p. 167-173.

The gallium is estimated fluorimetrically in chloroform solution as the oximate. Interfering ions and means of their removal were studied.

10d-25. Microdetermination of Zinc in Aluminum Alloys. D. F. Phillips and L. J. Holton. *Metallurgia,* v. 38, Aug. 1948, p. 237-239.

A recent paper by Townend and Whalley (June 1947 issue) describes a composite scheme for the microdetermination of Cu, Ni, Fe, Si, Ti, and Mn in Al alloys, using absorptiometric procedures. The method described uses an aliquot from the solution remaining after determination of the above elements.

For additional annotations indexed in other sections, see:
27a-122.



11
APPARATUS, INSTRUMENTS and METHODS

11-208. An X-Ray Method for Studying Skin Thickness of Bronze Castings. Carleton G. Lutts. *Non-Destructive Testing,* v. 6, no. 4, Spring 1948, p. 13-14, 21.

New technique for X-raying castings by cutting out thin slices of metal ⅛-in. thick through the full cross section of the casting and X-raying them with low voltage equipment. Resulting exographs reveal a strikingly different condition at the surface of a casting as compared to the center portions. Method is more useful for research or development work than for production control.

11-209. A Portable Ultrasonic Thickness Gage. Dwight J. Evans. *Non-Destructive Testing,* v. 6. No. 4, Spring 1948, p. 22-24, 42.

Theory of operation, and application of the "Audigage" in thickness determinations of steel pipes, tanks, pressure vessels, and other structures accessible from only one side.

11-210. Tracer Isotopes. *Engineer,* v. 186, July 30, 1948, p. 110-111.

Application to metallurgical problems.

11-211. Steel Mill Applications of Electronic Control. J. Raymond Erbe. *Iron and Steel Engineer,* v. 25, Aug. 1948, p. 93-101.

In many cases, electronic control offers a more simple design than conventional equipment. Several electronic applications which are now in operation in the steel industry.

11-212. Application of Similarity Principles to Metallurgical Problems. M. W. Thring. *Research,* v. 1, Aug. 1948, p. 492-500.

The role of model studies as a scientific technique. Fundamental principles for the construction of dynamic models.

11-213. Neutron Diffraction and Associated Studies. Part II. E. O. Wollan and C. G. Shull. *Nucleonics,* v. 3, Aug. 1948, p. 17-31.

Theory and procedures for the application of neutron diffraction techniques to problems in crystallography, metallurgy, and fundamental nuclear physics. 42 ref.

11-214. A Method for the Evaporation of Alloys. Louis Harris. *Journal of Applied Physics,* v. 19, Aug. 1948, p. 739-741.

A method for evaporation of alloys in high vacuum which should be applicable to all alloys that are not refractory. The method has been tested on alpha-brass and beta-brass and on a gold-cadmium alloy.

11-215. Measurements of Thomson Coefficients for Metals at High Temperatures and of Peltier Coefficients for Solid-Liquid. Interfaces of Metals. J. J. Lander. *Physical Review,* ser. 2, v. 74, Aug. 15, 1948, p. 479-488.

Apparatus devised for measuring Thomson coefficients of metals at high temperatures. Experimental results for the Peltier coefficients for solid-liquid interfaces of gold, silver and copper are reported.

11-216. New Worlds for Sight. James Hillier. *Physics Today,* v. 1, Sept. 1948, p. 18-25.

Some of the many applications of the electron microscope. Explains the construction and operating principles of this instrument; its limitations and present and potential uses. An excellent collection of electron micrographs.

11-217. Measurement of Radioactive Isotopes. *Technical News Bulletin.* (National Bureau of Standards), v. 32, Sept. 1948, p. 101-104.

Methods for use of the standard radioisotope samples now available from the Bureau.

11-218. Methods for Testing Thickness of Electrodeposits. I. Effect of Internal Stress on Thickness Determinations by the Jet Method. *Plating,* v. 35, Sept. 1948, p. 922-924, 966.

Shows experimentally that internal stress in an ordinary gray nickel deposit reduces its apparent thickness as determined by the jet test method proposed and widely used in England. High-temperature annealing, which is accompanied by grain growth, raises the apparent thickness much more than stress relieving at lower temperature, and restressing after high-temperature annealing only partially restores the nickel to normal reactivity.

11-219. Sur la détermination précise des constantes réticulaires de phases métalliques a cristallisation grossiere. (Concerning the Precise Determination of the Lattice Constants of Metallic Phases Consisting of Coarse Crystals.) René Graf and Sylvette Monteil. *Métaux & Corrosion,* v. 23, May 1948, p. 109-115.

Monochromatic diagrams of metallographic specimens of this type are very difficult to investigate. Theoretical study resulted in development of a method which makes it possible to obtain correct diagrams even in the case of monocrystals.

11-220. Sur une méthode d'essai rapide de résistance a l'érosion par cavitation. (A Rapid Method for Determination of the Resistance to Erosion By Cavitation.) Y. Bonnard and E. Josso. *Métaux & Corrosion,* v. 23, May 1948, p. 116-123.

Apparatus consists of a magnetostrictive generator of vibrations in the liquids in which the samples are immersed, which simulates the cavitation effect. Typical results for a series of ferrous and nonferrous alloys.

11-221. Applied X-Ray Metallography. (Continued.) Norman P. Goss. *Steel,* v. 123, Sept. 6, 1948, p. 114, 117, 132, 134-136, 138-139.

Elementary principles of lattice structure. Explanations of Miller indices and calculation of lattice parameters. (To be continued.)

For additional annotations indexed in other sections, see:
3a-105; 4c-52; 24a-204.

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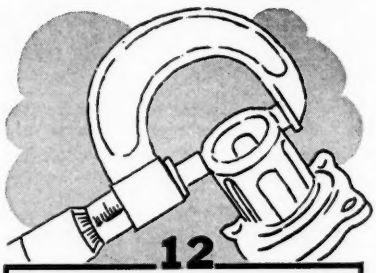


12
INSPECTION and STANDARDIZATION

12a—General

12a-87. Radioactive Isotopes as Sources in Industrial Radiography. Gerold H. Tenney. *Non-Destructive Testing,* v. 6, No. 4, Spring, 1948, p. 7-10.

Reviews basic facts of radioactivity and their application in field of metallurgy. Experiments on steel.

12a-88. Gauges in Modern Manufacturing. H. Kieffer. *Microtecnic* (English edition), v. 11, June 1948, p. 109-114. (Translated from the French.)

Advantages and disadvantages of the various systems.

12a-89. Gauging of Precision Screw Threads. A. C. Pruliere. *Microtecnic* (English edition), v. 11, June 1948, p. 115-122. (Translated from the French.)

Concludes descriptions of the various optical, optical-mechanical, and mechanical methods. Description of a simple mechanical device for measurement of the difference between desired and actual values of thread pitch. 20 ref.

12a-90. Metallurgical Control in Aircraft. *Western Machinery and Steel World,* v. 39, Aug. 1948, p. 100-103.

Methods for checking raw materials against a specification as done by a production metallurgist in an aircraft factory. Use of the spectrograph as an instrument for quality control.

(Turn to page 28)

History of Ammunition Traced at Manitoba

Reported by D. A. Thompson

Technician, Engineering Test Lab
University of Manitoba

"The History of Ammunition" was the subject of the first meeting of the season for the Manitoba Chapter A.S.M. on Sept. 9. J. W. Houlden, western sales representative for the ammunition division of Canadian Industries Ltd., was the speaker. During the war Mr. Houlden had served as ballistics engineer for the company.

Mr. Houlden traced the history and development of weapons and ammunition from prehistoric times up to the present day. While talking, he passed around a fine display of firearms for examination. Among the display were pieces of Damascus steel, cutaway sections of shells and firearms, progressively illustrated sections of shells from the blank to the finished product, and some very interesting photomicrographs.

Appropriately enough, the coffee talk was presented by E. George of the Consolidated Mining and Smelting Co., Ltd., a member of this year's Canadian Bisley shooting team. Mr. George described his experiences in competing in the world-famous Bisley shooting meet in England.

John Dow, Furnace Expert Fatally Injured by Fall

John A. Dow, president and founder of Dow Furnace Co., Detroit, was fatally injured by a fall on July 26. Born in Belwood, Ont., in 1902, he was graduated with honors from University of Toronto, School of Practical Science, in 1924 with the degree of Bachelor of Applied Science.

J. A. Dow

Shortly after graduation he came to the United States as a furnace sales engineer for Leeds and Northrup Co. In 1933 he joined Holcroft and Co. as metallurgical research and sales engineer. In 1935 he was granted U. S. Letters Patent on a method of producing a nondecarburizing gas atmosphere for use in heat treating various types of steel. Since that time several other patent applications have been filed, based upon his developments in the field of industrial heat treating equipment.

He organized the Dow Furnace Co. in 1946 and produced the first successful batch-type controlled atmosphere furnace for light case work. He is the author of the sections on gas carburizing and on carbo-nitriding in the new edition of the A.S.M. Metals Handbook.

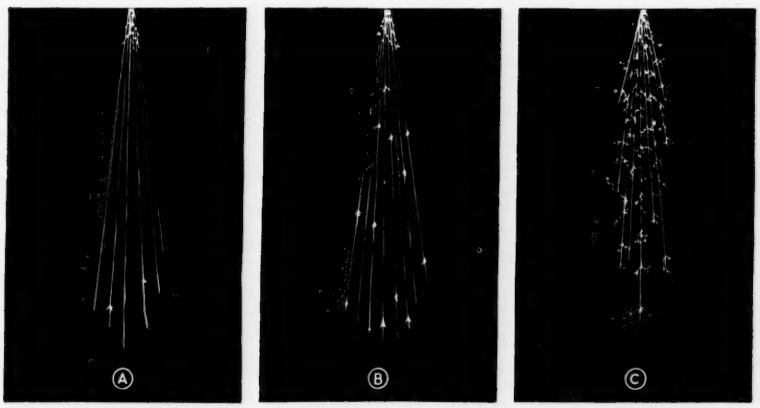
Welding Contest Opened

The James F. Lincoln Arc Welding Foundation has announced the dates Sept. 15, 1948 to April 1, 1949 as the period for submitting entries in its annual Engineering Undergraduate Award and Scholarship Program.

The current competition is the second in a ten-year series of programs which offer to engineering undergraduates the opportunity to compete in the preparation of papers on various phases of welding for monetary awards as well as scholastic and industry recognition. The rules of the program may be obtained by writing the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

T. G. Harvey Takes New Post

Thomas G. Harvey, member of the Indianapolis Chapter Executive Committee and former chapter chairman, has been appointed metallurgical engineer for the foundry division, Sonith Industries, Inc., Indianapolis. This organization, a producer of ferrous and nonferrous castings, is a newly licensed producer of Meehanite castings. Mr. Harvey was formerly chief metallurgist, Monarch Steel Co.



Mark your answers here. Carbon content of steel A. is __% B. is __% C. is __% Correct spark readings are given at lower left.

Can You Read These Sparks?

They Describe the Analyses of Three Steels

Steel bars of three different analyses gave off the sparks pictured above when touched by a revolving abrasive wheel. At Ryerson, we "read" these sparks to protect your production.

To the trained eyes of our experts, the spark pattern of a steel is as distinctive as a fingerprint. For example, the sparks shown here indicate straight carbon steels, with carbon content in the low, middle and high ranges. If chrome, nickel, molybdenum or other alloying elements were present, they would also be revealed in the spark pattern.

That's why spark testers patrol the bar sections of your nearby Ryerson plant. By checking all alloy and special quality carbon bar stock, they guard against mixed shipments. Help to assure the certified quality of Ryerson steels.

HERE ARE THE ANSWERS:
A—.10% B—.35% C—.95%

Spark testing is only one of many extra steps we take to make Ryerson a steel source you can call with confidence. Another—the special Ryerson Report sent with each alloy shipment. It charts the results of hardenability tests, shows how to heat treat for desired mechanical properties and includes other helpful data.

So play safe. Avoid the possibility of mixed steels by ordering from your nearest Ryerson plant.

PRINCIPAL PRODUCTS
BARS—carbon & alloy, hot rolled & cold fin., reinforcing
STRUCTURALS—I beams, H beams, channels, angles, etc.
PLATES—Sheared & U. M., Inland 4-Way Floor Plate
SHEETS—hot & cold rolled, many types & coatings
TUBING—Seamless & welded mechanical & boiler tubes
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MACHINERY & TOOLS

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco

RYERSON STEEL

12a-91. Acceptance Standards in Radiographic Inspection. C. Croxson. *Welding*, v. 16, Aug. 1948, p. 324-329.

A critical review makes reference to both American and German practices.

12a-92. Engineers Seek Uniformity in Nondestructive Testing. *SAE Journal*, v. 56, Sept. 1948, p. 25-26, 40. Based on "Application of Nondestructive Testing to Automotive Parts", by D. M. McCutcheon.

Problems involved in standardization of test methods.

12a-93. Is Statistical Quality Control of Value in Manufacturing? *American Machinist*, v. 92, Sept. 9, 1948, p. 86-87.

"No!" says Chief Tool Engineer Bryan D. Miller, who relates an actual experience and comes forth with an indictment. "Yes!" says quality Control Engineer Clifford W. Kennedy, who comments on the experience and defends the statistical method.

12a-94. How to Specify Surface Quality. J. F. Fischer. *Machinery*, v. 55, Sept. 1948, p. 174-177.

Details of application of American Standard (Part I of A.S.A. B46. 1-1947) entitled, "Surface Roughness, Waviness, and Lay."

12a-95. How Smooth is Smooth? Specification and Evaluation of Machined Finishes. Ben C. Brosheer. *American Machinist*, v. 92, Sept. 9, 1948, p. 97-112; Sept. 23, 1948, p. 111-122.

Details of various methods for the above and of the different standard specifications, specimen blocks, and measuring and inspection equipment. Part II deals with optical comparators. 113 ref.

12b—Ferrous

12b-49. Gamma-Ray Radiography in a Steel Foundry. Robert A. Willey. *Non-Destructive Testing*, v. 6, no. 4, Spring 1948, p. 15-18.

Various examples and problems which led to development of a radiographic procedure at the Commercial Steel Casting Co., Marion, Ohio.

12b-50. Power Plant Pipe Welds; Radiographic Examination on Site. James F. Magee. *Welding*, v. 16, Aug. 1948, p. 330-334.

Views of an Australian powerplant purchaser on the question of the site use of radiographic examination of welds in high-pressure steam pipes.

12b-51. Standards for Welds in Ship Construction; Present Scope of Radiographic Inspection. R. J. W. Rudkin. *Welding*, v. 16, Aug. 1948, p. 335-338.

Believes that before acceptance standards can be formed for welded joints in complex structures such as ships, a very much greater knowledge is required of the effect of various defects, and of different proportions, on the load-carrying capacity of the joints used.

12b-52. Radiological Standards for Pipe Welds; Comments and Recommendations. W. J. Wiltshire. *Welding*, v. 16, Aug. 1948, p. 339-345.

Satisfactory examination techniques. Believes that there is no reason why standards for pipe welds should be lower than those for pressure vessels and draws attention to the need for more correlation of weld defects with the flaws shown by radiography.

12b-53. Welds in Armour; The Search for Standards. O. E. Chapman, and R. W. Angle. *Welding*, v. 16, Aug. 1948, p. 345-349.

The special difficulties associated with radiographic examination of armor plate welds. Other forms of nondestructive examination.

12b-54. Supersonic-Radiographic Inspection. *Production Engineering & Management*, v. 22, Sept. 1948, p. 56.

Recommends use of combination of the two types for best results. On completion of supersonic inspection of butt welding in pressure containers, the most defective portions (about 10%) were given a radiographic check, since the supersonic method gives little quantitative information concerning the nature and extent of defects.

12b-55. Inspection of Precision Aircraft Gears. D. W. Dudley. *Machinery*, v. 55, Sept. 1948, p. 151-157.

Methods and equipment used by General Electric to check high-speed gears for aviation gas turbines.

12c—Nonferrous

12c-8. Radiographic Tests of Gun Metal Castings. William H. Baer. *Non-Destructive Testing*, v. 6, no. 4, Spring 1948, p. 33-39.

Inspection technique in identification of various typical defects.

12d—Light Metals

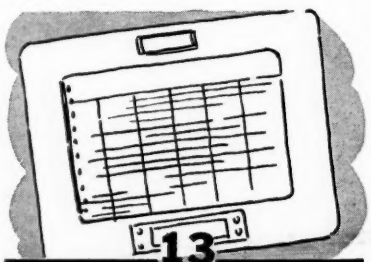
12d-12. Radiography as a Control in Aluminum Alloy Spot Welding and the Fabrication of Plastic Honeycomb Panels for Aircraft. Floyd Chitty. *Non-Destructive Testing*, v. 6, no. 4, Spring 1948, p. 11-12.

Technique developed by Glenn L. Martin Co.

12d-13. Kontrola vyroby hlinikové folie röntgenovymi paprsky. (Control of the Production of Aluminum Foil by Means of X-Rays.) Petr Skulari. *Hitnické Listy*, v. 3, April-May 1948, p. 116-120.

Proposes several methods for X-ray analysis of the microstructure of the above foil which enables one to judge the quality of the finished product and to predict the behavior of the foil in practical application.

For additional annotations indexed in other sections, see: 27a-119.



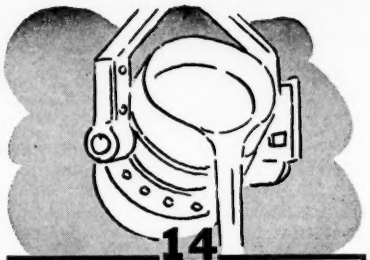
13
TEMPERATURE MEASUREMENT and CONTROL

13-37. Comparison of Systems for Controlling Gas-Fired Furnace Process Temperature. Harold E. McClatchey. *Petroleum Processing*, v. 3, Sept. 1948, p. 878-880.

Details of three methods for controlling process temperatures in a gas-fired furnace, and advantages and limitations of each.

13-38. Thermostatic Bimetals. Ernest R. Howard. *Product Engineering*, v. 19, Sept. 1948, p. 106-110.

Uses of the above for controls. Functional applications showing uses, load and deflection formulas, and time response characteristics.



14
FOUNDRY PRACTICE

14a—General

14a-141. Die Lunkerbildung und die quantitätive Berechnung ihrer Gröbe. (Cavities or "Pipes" in Castings and the Quantitative Calculation of Their Size.) F. Sauerwald. *Archiv fur Metallkunde*, v. 1, Sept. 1947, p. 403-408.

Factors responsible for formation of cavities during solidification of castings and methods for calculating the size of cavity formed under specific conditions.

14a-142. Hydraulické reseni vtoku licich forem. (Determination of the Dimensions of Pouring Gates by a Hydraulic-Analogy Method.) Jan Kieswetter. *Hutnicke Listy*, v. 3, June 1948, p. 165-170.

A theoretical analysis of the problem.

14a-143. Precision Investment Casting. *Canadian Metals & Metallurgical Industries*, v. 11, Aug. 1948, p. 14-16, 34.

Methods employed at Bayonne Works, International Nickel Co.

14a-144. Core Baking; An Interesting American Development in Foundry Practice. *Automobile Engineer*, v. 38, Aug. 1948, p. 314.

Induction-heating, tunnel-type, continuous unit.

14a-145. Precision Castings. *Mining and Metallurgy*, v. 29, Aug. 1948, p. 450-451.

The applications, limitations, and steps in the lost-wax method.

14a-146. Some Fundamental Problems in Foundry Planning. Jorgen Drachmann. *Foundry Trade Journal*, v. 85, Aug. 5, 1948, p. 121-127.

Problems and application of principle of total load and principle of margin to a foundry system.

14a-147. Using an Old Technique to Make Parts Too Difficult to Produce by Other Means. Joseph Geschelin. *Automotive Industries*, v. 99, Aug. 15, 1948, p. 28-30, 70, 72, 76.

How Allison-Bedford Foundry of General Motors specializes in casting aluminum parts by Antioch plaster mold process for Buick torque converters, Detroit diesel engines and other equipment.

14a-148. Repetition Pattern Making. K. L. Futter. *Foundry Trade Journal*, v. 85, Aug. 19, 1948, p. 176-179.

A survey of methods.

14a-149. Die Lubrication; Contributing Factor to Profitable Die Casting. H. Pocock and J. L. Erickson. *Metal Industry*, v. 73, Aug. 20, 1948, p. 143-145; Aug. 27, 1948, p. 166-168.

Why a die lubricant is needed; what properties it must possess; what lubricants possess the required properties; and how they should be applied. Concluding installment deals with coolants; insulating media; reducing cold shuts; plunger lubricants; types of lubricant; and silicones and their application.

14a-150. Precision Investment Casting At International Nickel Co. Robert H.

(Turn to page 30)

Syracuse Celebrates Crucible Steel Night

Reported by Harry A. Johnson
Aircooled Motors, Inc.

The first meeting of the season for the Syracuse Chapter A.S.M. on Sept. 7 was designated "Crucible Steel Night" and was sponsored by the Sanderson-Halcomb Works, Crucible Steel Co. of America. The principal speaker was Peter Payson, assistant director of research for Crucible Steel Co.; his talk on "Tool and Die Steels" was primarily educational in nature.

Mr. Payson based his lecture on five different steels ranging from a water hardening plain carbon steel to the highly alloyed steels for high-temperature use and other special purposes. These particular steels were selected only for purposes of illustration and not as recommended compositions, although he pointed out that with proper treatment one or another of the five could, if necessary, be made to serve almost any tool or die purpose.

Preceding Mr. Payson's lecture, Howard Stagg, metallurgist at Sanderson-Halcomb Works and first chairman of the Syracuse Chapter, gave a short talk reviewing the early history of A.S.M. and its predecessor organizations. He gave a first-hand account of the Steel Treating Research Club founded by Billy Woodside in 1914 and of the eventual formation of the A.S.M. with headquarters in Cleveland. He also called attention to the contributions made over a period of 72 years by Crucible Steel Co. to this community.

Another interesting feature of the evening was a coffee talk by Tom Bost of General Electric Co. on "The Future of Television in Syracuse".

Kristufek Is Transferred

Frank C. Kristufek, formerly a member of the physical metallurgy department of the U. S. Steel Research Laboratory at Kearny, N. J., and reporter to *Metals Review* of New Jersey Chapter meetings and activities, has been transferred to the Columbia Steel Co. at Torrance, Calif., as a senior metallurgist.

X-Ray Lab Dedicated

The largest X-ray development laboratory in the world was dedicated in Milwaukee by the General Electric X-Ray Corp. on Sept. 13, as a permanent living tribute to William D. Coolidge, 75-year-old X-ray pioneer and director emeritus of the G. E. Research Laboratory, Schenectady, N. Y.

Ceremonies for the dedication were witnessed by more than 1500 visitors, including many of the nation's radiologists, physicists, military experts and research scientists. Known throughout the scientific world as "the father of the modern X-ray tube", Dr. Coolidge has been honored by 13 medals and seven honorary degrees from scientific and educational organizations, and is the holder of 83 patents.

Columbus Technical Council Names First President

Charles F. Lucks, one of the key men in the promotion and development of a technical council for Columbus, will serve as the first president of the recently incorporated Columbus Technical Council, with which Columbus Chapter A.S.M. has been affiliated.

C. F. Lucks

Mr. Lucks, former treasurer, vice-chairman and chairman of Columbus Chapter A.S.M., is a physicist on the staff of Battelle Memorial Institute, where he has charge of the Institute's instruments, heat treating, mechanical testing, thermal conductivity and glass blowing laboratories. He is a graduate in engineering physics of Ohio State University. Prior to joining Battelle in 1930, he was associated with B. F. Goodrich Co.

In addition to the American Society for Metals, Mr. Lucks is a member of American Physical Society, American Association of Physics Teachers, Instrument Society of America, and the American Association for the Advancement of Science.

New Members of A.S.M. Quarter-Century Club

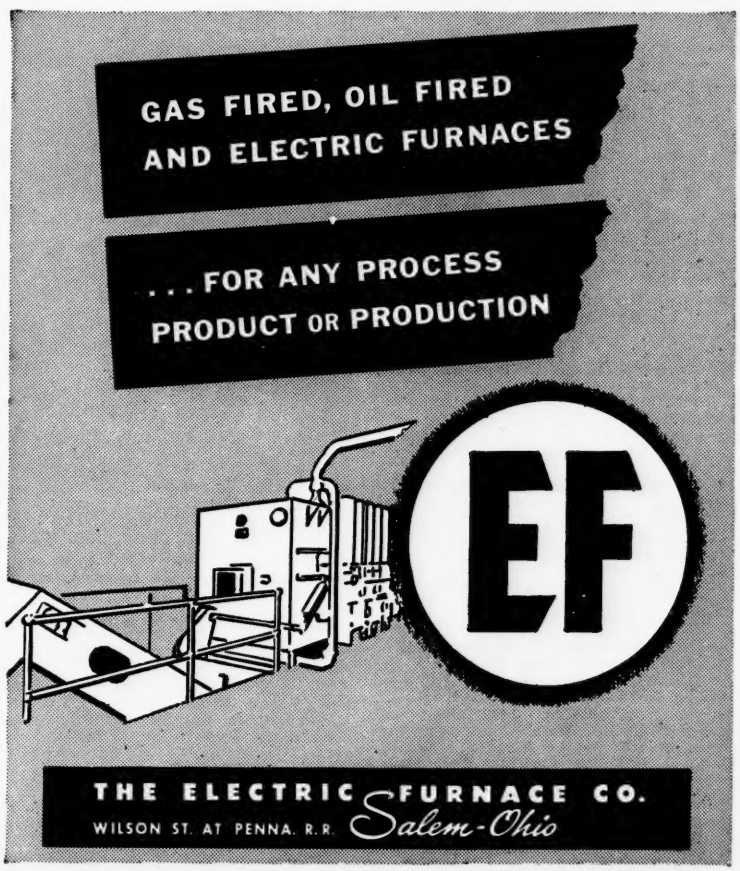
The following A.S.M. members have been awarded honorary certificates commemorating 25 years' consecutive membership in the society:

Columbus Chapter—R. E. Christin, Howard C. Cross, Dana J. Demorest, L. D. Gable, H. W. Gillett, James O. Lord, Samuel Z. Krumm, Charles E. MacQuigg, H. W. Rushmer.

Philadelphia Chapter—George A. Richardson.

Cowles Changes Name

At a special meeting on Aug. 16, the stockholders of the Cowles Detergent Co., Cleveland, approved a resolution changing the firm's name to Cowles Chemical Co. The change was deemed advisable because of the increasing diversification of the company's business, which is no longer restricted to detergents.



Herrmann. *Foundry*, v. 76, Sept. 1948, p. 94-98, 188, 190, 193, 196-198.

14a-151. Metal Cope and Drag Patterns. Roy A. Loder. *Foundry*, v. 76, Sept. 1948, p. 146, 148.

Method of making these patterns.

14a-152. Mechanized Foundry Operations. *Steel*, v. 123, Aug. 30, 1948, p. 81, 84.

Transformation of molten metal to finished castings in 1¼ hr.

14a-153. Sable de Moulage Etuvé. (Molding Sand.) Pierre Nicolas. *Fonderie*, May 1948, p. 1172-1176.

Results of a comparative investigation of use of green and dry sand. Effects of various sand factors on quality of the castings.

14a-154. Foundry Sands Evaluated; Naturally Bonded Vs. Synthetic Sands. C. A. Sanders. *American Foundryman*, v. 14, Sept. 1948, p. 45-49.

Advantages and disadvantages of the various types. 29 ref.

14a-155. Unit Casting Cost Greatly Reduced by Automatic Molding. John A. Sharritts. *Steel*, v. 123, Sept. 20, 1948, p. 126, 128, 132.

Previously abstracted from *Foundry*, v. 26, June 1948, p. 78-85, 216, 218, 220, 222, 224.

14b—Ferrous

14b-92. Centrifugal Casting. J. E. Hurst. *Iron and Steel*, v. 21, Aug. 1948, p. 355-361.

Development and application.

14b-93. Use of Synthetic Sand for Cast Magnets. R. S. Turner. *Foundry Trade Journal*, v. 85, Aug. 12, 1948, p. 153-154.

Results of experiments conducted with the objects of reducing facing-sand costs, of obtaining smoother finishes on the castings, and of finding a sand suitable for some very small magnets which had to meet close tolerances in the as-cast condition. Compositions of suitable mixes.

14b-94. Anthracite-Coke Mixtures Used in High Speed Cupola Melting. C. C. Wright and W. J. Reagan. *American Foundryman*, v. 14, Sept. 1948, p. 37-44.

Successful use of coal in production-melting operations carried on over a great part of 1947. The practice developed is currently in use. Suggestions for improving on the techniques described.

14b-95. Centrifugal Casting of Steel (Cont.) John Howe Hall. *Foundry*, v. 76, Sept. 1948, p. 74-77, 228-230, 232, 234, 236, 238.

True centrifugal process and semi-centrifugal method of producing steel castings. 10 ref. (To be concluded.)

14c—Nonferrous

14c-49. Gas Porosity in Nickel-Silver Castings. T. F. Pearson, W. A. Baker, and F. C. Child. *Foundry Trade Journal*, v. 85, Aug. 12, 1948, p. 145-151; discussion, p. 151-152.

Previously abstracted from *Metal Industry*, v. 72, June 11, 1948, p. 483-486; June 18, 1948, p. 506-507. See item 14c-42, 1948.

14c-50. Continuous Casting—the Asarco Process. J. S. Smart, Jr., and A. A. Smith, Jr. *Iron Age*, v. 162, Aug. 26, 1948, p. 72-80.

First extensive description of Asarco units. Work done on the Asarco process by American Smelting & Refining Co. in the production of copper and copper-base alloys.

14c-51. High Quality Pressure Die Castings. James L. Erickson. *Metallurgia*, v. 38, Aug. 1948, p. 212-214.

One of the difficulties in the production of heat treated Al-alloy diecastings is the blistering which occurs on heating to solution-treatment temperatures, as a result of the die-cavity air being trapped in the casting. Various points raised are believed of value in connection with the production of die castings from other alloys.

14c-52. Asbestos Additions Improve Nonferrous Foundry Sands. J. W. Horner, Jr. *American Foundryman*, v. 14, Sept. 1948, p. 59-62.

Use of 10% by volume of asbestos was first tried on an experimental basis for molding a bronze cylinder casting which had caused much trouble on account of various defects. Use of asbestos remedied the difficulties.

14d—Light Metals

14d-46. The Casting of Marine Bronze Propellers. (Concluded.) F. J. Tector, and J. Martland. *Foundry Trade Journal*, v. 85, July 29, 1948, p. 99-100; discussion, p. 100-104.

The sand plant and sand handling, and production results.

14d-47. Casting Aluminum Pistons in Permanent Molds. Robert H. Herrmann. *Foundry*, v. 6, Sept. 1948, p. 78-83, 130, 132.

Production methods at Thompson Products Inc., Tapco plant, Cleveland.

14d-48. Un tour d'horizon sur les fonderies francaises d'alliages legers. II. La technique du moulage. (A Survey of French Light-Alloy Foundries. II. The Technique of Casting.) Charles Roinet. *Revue l'Aluminium*, v. 25, July-Aug. 1948, p. 223-227.

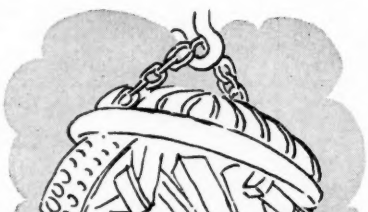
To be continued.

14d-49. Precision Casting—A Production Achievement! Chester S. Ricker. *Tool Engineer*, v. 21, Sept. 1948, p. 27-29.

Production of Buick "Dynaflow" torque-converter drive units from Al alloy by the Antioch process.

For additional annotations indexed in other sections, see:

3b-128; 3d-45; 4b-57; 11-208; 16b-80; 20a-338; 24b-86; 27d-15.



15

SCRAP and BYPRODUCT UTILIZATION

15a—General

15a-13. Segregation and Collection of Industrial Scrap. Marcus E. Borinstein. *Better Enameling*, v. 19, Aug. 1948, p. 9-11, 30.

Waste in handling; methods for reducing loss in scrap value.

15b—Ferrous

15b-42. 8-Ton Casting Repaired by Welding Crack. Margaret Ralston. *Welding Engineer*, v. 33, Sept. 1948, p. 38-39.

Welding of cracked water jacket of diesel engine, having walls 2¼ to 6 in. thick. It was repaired by use of oxy-acetylene torches and cast-iron filler rods.

15b-43. Weld Repairs on Tubing Stress-Relieved With Water-Cooled Copper Induction Coils. E. K. Dewey. *Petroleum Processing*, v. 3, Sept. 1948, p. 845-846.

Method for the above.

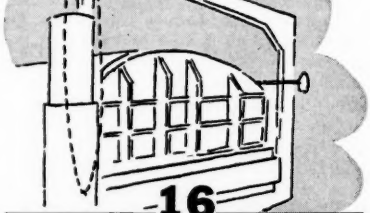
15b-44. Future Scrap Sources for the Steel Plants. C. R. Holton. *Steel*, v. 123, Sept. 13, 1948, p. 128, 130, 132, 135, 138, 140, 142, 145-146.

Reviews lessons learned during World War II, the more important of which were more systematic methods of collection; careful segregation into grades; and facilities for shearing, briquetting, bundling, cleaning, and degreasing.

15d—Light Metals

15d-11. Zpracovani hlinikovych odpadu, zejmena na slévaranské slitiny. (Utilization of Scrap Aluminum, Especially for Casting.) Karel Horacek. *Hutnické Listy*, v. 3, April-May 1948, p. 146-151.

Czechoslovakian practice and proposed standardization of casting alloys.



16

FURNACES and HEATING DEVICES

16a—General

16a-80. Induction and Dielectric Heating. G. W. Scott. *Electrical Engineering*, v. 67, Sept. 1948, p. 847. Based on paper to be published in *A.I.E.E. Transactions*, v. 67, 1948.

Principles, advantages, and applications.

16a-81. Tagged Atoms Go to Work for Steel. Charles Ellsworth. *Steelways*, Sept. 1948, p. 26-28.

Tells how radioactive sulphur was used to follow the sulphur atoms in coal through the coking process, leading to the conclusion that it is impossible to get low-sulphur coke by buying coal which, though high in sulphur content, might contain its sulphur in a form which would largely eliminate itself during coking.

16a-82. Electric Firing Cheap as Gas, Oil in Shortest Continuous Furnace. *Ceramic Industry*, v. 51, Sept. 1948, p. 72-73.

Continuous, automatic, straight-through, electric, porcelain-enameling furnace.

16a-83. Straight-Line Heating Provides Fast Method of Processing Long Straight Metal Stock. S. M. Stoler. *Steel*, v. 123, Sept. 13, 1948, p. 105-106.

"R-S Hi-Head" system which consists essentially in use of an extremely high thermal head in multiple heating chambers through which the workpieces are rapidly passed by mechanical means. Uni-

(Turn to page 32)

Prof. Clayton Dies, Was A.S.M. Trustee

Charles Y. Clayton, professor of metallurgical engineering, Missouri School of Mines and Metallurgy, died last June of a heart attack following a stroke suffered earlier in the spring. Professor Clayton served on the A.S.M. national board of trustees in 1940-41.

C. Y. Clayton

A graduate of Missouri School of Mines in 1913, he had been associated with the department of metallurgy and ore dressing of that school periodically ever since. During World War I he was employed as a metallographist at the Bureau of Mines in Pittsburgh, assigned to the Central Control Laboratory, Ordnance Department, U. S. Army. He did consulting work for this bureau at various times in later years, was associated with the U. S. Bureau of Standards investigating mining drill steel in 1922, and served as rock drill metallurgist at Vanadium-Alloys Steel Co., Pittsburgh, in 1930.

Professor Clayton was largely instrumental in the formation of the Missouri School of Mines Group of the American Society for Metals in 1937, and served as faculty advisor for many years.

Quality Control Conference In Chicago, Nov. 4-5

The eight midwest sections of the American Society for Quality Control will hold their Third Midwest Quality Control Conference at the Sherman Hotel in Chicago on Nov. 4 and 5. The conference is again being sponsored by the Chicago Association of Commerce.

Prof. Lloyd A. Knowler of the University of Iowa, chairman of the program committee, has organized an excellent group of speakers for both the clinical and training sessions. Highlighting the conference program will be the luncheon sessions, at which two top-ranking business executives will give down-to-earth talks on the benefits of statistical quality control applications in their plants.

In addition, the conference will feature many exhibits, where the latest devices for measurement and control will be demonstrated.

The cost of the two-day meeting, including luncheons and sessions, is $15. Further details may be obtained from the Third Midwest Quality Control Conference, P. O. Box 1097, Chicago.

Norton Sales Engineer Killed in Plane Crash

Carl A. Carlson, sales engineer for Norton Co., Worcester, Mass., died on Aug. 29 in a plane crash near Winona, Minn.

Born in Stockholm, Sweden, in 1888, Mr. Carlson graduated from the Sala Engineering School and came to the United States in 1912. He began his long career with Norton Co. in 1913 in the machine shop.

In 1920 he went to France to aid in the organization of a branch plant. Returning to Worcester in 1922, he was appointed to the sales engineering department the following year, where he has remained ever since.

Mr. Carlson was the inventor of a billet grinding machine and a wire grinding machine, and his influence was a vital factor in the establishment of high-speed grinding. He directed his company's activities in a successful program to develop resinoid bonds for high-speed grinding in foundries and steel mills throughout the United States. Mr. Carlson was a leading consultant on snagging operations and the author of many technical articles on grinding.

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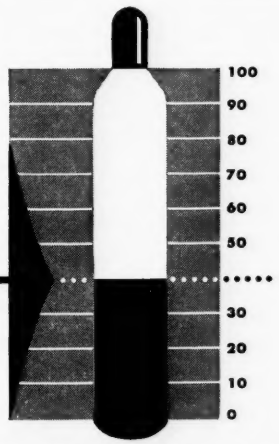

For many metal treating applications, dissociated ammonia can reduce your hydrogen costs as much as 60% because: (1) the cost of dissociated ammonia is considerably less than hydrogen per thousand cubic feet of gas . . . (2) one cylinder of ammonia when dissociated supplies as much gas as approximately 34 cylinders of hydrogen, thus greatly reducing cylinder handling and storage problems. You'll find, too, that the low moisture content of dissociated ammonia (Dew Point -60°F.) results in brighter work. The lower pressure of the anhydrous ammonia in the cylinder simplifies control.

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Max. Hrly. H_2 Req._____ CF

form heating from skin to core is thus accomplished, while surface scale, decarburization, and grain growth are precisely controlled, resulting in high-quality output.

16a-84. Industrial Electronic Heating. *Brown Boveri Review,* v. 35, March-April 1948, p. 95-98.

Principles and industrial application of high-frequency heating for metallic and nonmetallic materials.

16a-85. Four Station Electric Resistance Heater. *Product Engineering,* v. 19, Sept. 1948, p. 90-92.

Equipment for heating forging blanks.

16a-86. Needs in Furnace Development and Fuel Utilization for the Metal Industry. F. E. Harris. *Industrial Heating,* v. 15, Sept. 1948, p. 1514, 1516, 1518, 1520, 1522, 1524, 1526, 1528, 1538.

Heating rates, problems in heat application and surface effects, and problems other than heating. Differential heating, effect of head temperatures on heating time, heating in batch furnaces, heating in a continuous furnace, location of thermocouples, furnace ratings at various head temperatures, a soldered plug assembly, processing of springs, and atmosphere control.

16a-87. Oil-Fired Open Hearth Furnaces; A Review of British Practice. T. C. Bailey. *Institute of Petroleum and Institute of Fuel, Joint Conference on Modern Applications of Liquid Fuels,* Birmingham Univ., London, Sept. 21-23, 1948, (Advance Copy), 18 pages.

Attempts to establish what may be considered standard practice. Where improvements are necessary, suggesting probable lines of development.

16b—Ferrous

16b-76. Note sur le soufflage de l'hydrogene dans les hauts fourneaux. (Note Concerning the Hydrogen Blast in the Blast Furnace.) J. G. Platon. *Revue de Métallurgie,* v. 45, March-April 1948, p. 118-119.

Calculations on the use of fuel oil (containing about 85% C and 15% H_2) in the blast furnace with resulting savings in coke consumption.

16b-77. Electric Furnaces for the Wire Industry. Part 3. H. J. Tucker and J. A. Monks. *Wire Industry,* v. 15, Aug. 1948, p. 519-520.

Equipment and processes.

16b-78. Electrical Heating of Steel Strip for Continuous Processing. A. R. Ryan and F. E. Ackley. *Iron and Steel Engineer,* v. 25, Aug. 1948, p. 66-78; discussion, p. 78-80.

Electrically heated protective-atmosphere furnaces, resistance furnaces, and induction furnaces all offer interesting possibilities for continuous processing in various departments of the steel plant.

16b-79. Construction of Cable Tool Bit Forges. Ferd J. Spang. *Petroleum Engineer,* v. 19, Aug. 1948, p. 55-56, 61-62.

Method of preparing a forge from oil drums and arranging manner of mixing and burning fuel so that heat will permit the tool bit to be dressed with minimum of effort and slight loss from scaling and burning.

16b-80. Here's a Way to Preheat Castings. Build a Temporary Firebrick Furnace To Do the Job. F. C. Geibig. *Welding Journal,* v. 27, Aug. 1948, p. 591-592.

Steps in building furnace.

16b-81. Rapid Billet Heating With Gas. L. J. Stanbery and J. M. Brennan. *Iron Age,* v. 162, Aug. 26, 1948, p. 82-85.

A newly developed forging billet heating furnace which heats work to 2200 to 2300° F. at a rate of up to 440 pieces per hr. with a minimum of oxidation. Containing a number of unusual design features, including water-cooled skidway rails, the furnace is said to have a normal refractory life. Construction, heating rates, atmospheres, controls, operating costs and furnace life.

16b-82. Electric Oven Annealing of Malleable Iron Castings. F. W. Jacobs. *Foundry,* v. 76, Sept. 1948, p. 68-73, 129.

Lake City Malleable, Inc., Ashtabula Installations and procedure at the la, Ohio.

16b-83. Furnace Brazing Pulleys and Sheaves Cuts Production Costs. T. E. Nelson *Iron Age,* v. 162, Sept. 2, 1948, p. 92-94.

Use of a furnace-brazed assembly for producing a power lawnmower pulley, which results in a reduction in manufacturing costs of 10 cents per part. A description of the furnace and operating costs.

16b-84. Openhearth Fume Control. E. S. Kopecki. *Iron Age,* v. 162, Sept. 9, 1948, p. 78-80.

The openhearth fume problem, heightened by use of the oxygen lance, has recently been solved at Republic by application of a venturi scrubbing unit. Construction and performance of this scrubber, which is already being tested for possible use in conjunction with other steelmaking operations.

16b-85. Describes Electric Furnace Malleablizing Operations. H. R. Cowles. *American Foundryman,* v. 14, Sept. 1948, p. 50-53.

Equipment and procedures at Lake City Malleable Inc., Ashtabula, Ohio.

16b-86. The Present Outlook for Coal. *Industrial Heating,* v. 15, Sept. 1948, p. 1506, 1508, 1510, 1512.

Summarizes three papers on the uses of coal in the steel industry: it and its by-products; uses in other industries now and in the future; and coal in national and international economics. Presented at recent joint meeting of the Engineers' Society of Western Pennsylvania and the A.I.M.E. in Pittsburgh.

16b-87. The Use of Fuel Oil in Furnaces for the Iron and Steel Fabricating Industries. M. Roddan. *Institute of Petroleum and Institute of Fuel, Joint Conference on Modern Applications of Liquid Fuels,* Birmingham Univ., London, Sept. 21-23, 1948, (Advance Copy), 47 pages.

Actual cases of use of oil in furnaces for forging, pin heating, annealing, plate heating, rolling mill, slab reheating, wrought-iron pile reheating, strip heating for conduit welding, iron melting, vitreous enameling, and terne coating. Consumption, efficiencies, and conditions.

16c—Nonferrous

16c-6. Fuel Factors in Non-Ferrous Fabrication. Leslie Aitchison. *Institute of Petroleum and Institute of Fuel, Joint Conference on Modern Applications of Liquid Fuels,* Birmingham Univ., London. Sept. 21-23, 1948, (Advance Copy) 9 pages.

For a variety of nonferrous metallurgical processes.

16d—Light Metals

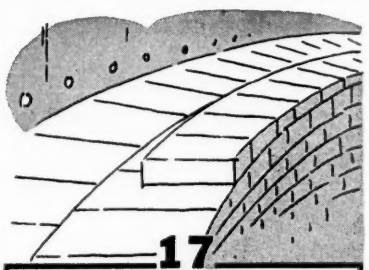
16d-2. Forni ad induzione tipo Bora. (Induction Furnaces of the "Bora" Type.) E. Calamari. *Alluminio,* v. 27, March-April 1948, p. 150-157.

Difficulties in introduction to aluminum industry. Most convenient type of such furnaces.

16d-3. Age Hardening of Aluminum at Boeing Aircraft Co. *Instrumentation,* v. 3, Third Quarter 1948, p. 25.

Large age hardening oven characterized by versatility, close automatic control, and uniformity of oven temperature. System of automatic control.

For additional annotations indexed in other sections, see: 14a-144.



17 REFRACTORIES and FURNACE MATERIALS

17-80. Chemical and Mineralogical Changes in Stack and Hearth Refractories of a Blast Furnace. L. H. Van Vlack. *Journal of the American Ceramic Society,* v. 31, Aug. 1948, p. 220-235.

Refractory samples removed from the lining of a blast furnace exhibiting normal behavior were analyzed for chemical and mineralogical changes. The changes observed in the lining of this furnace and their probable effect upon the refractory life. Suggestions regarding blast-furnace refractory practice. 24 ref.

17-81. Permanente Metals Corporation Making Refractories History on West Coast. *Brick & Clay Record,* v. 113, Aug. 1948, p. 66, 68, 70.

Development of a material for special high-temperature applications that will withstand a load of 25 psi. up to a temperature of 4000° F. without shearing.

17-82. Sonic Method for Measurement of Young's Modulus of Elasticity of Refractories. Kenneth A. Baab and Hobart M. Kraner. *Industrial Heating,* v. 15, Sept. 1948, p. 1580, 1582. A condensation.

Method was applied to 21 samples. Each sample was then tested for modulus of rupture, bulk, specific gravity, true specific gravity and true and apparent porosity, using standard A.S.T.M. methods; and results were plotted against cone-firing temperatures.

For additional annotations indexed in other sections, see: 5a-51.

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Metallurgical Books

By Sibyl E. Warren
Lingren Library, Mass, Inst. of Technology

A Bibliography, Classified by Subject Matter, of Metallurgical and Near-Metallurgical Books Published in the Years 1936-1946

THIS is the seventh installment in this bibliography, which began in the March issue of *Metals Review*. The present portion starts with Part II on Metals (in General), as shown in the classification scheme alongside. Subsequent issues will carry succeeding sections of the bibliography.

* * *

II. Metals

(In General)

Arkel, A. E., van, ed. **Reine Metalle: Herstellung, Eigenschaften, Verwendung.** J. Springer, Berlin, 1939, 574 p.

Burgel, Heinrich. **Deutsche Austausch-Werkstoffe.** J. Springer, Berlin, 1937, 154 p.

Camm, F. J., ed. **Dictionary of Metals and Alloys.** Ed. 3. G. Newnes, Ltd., London, 1944, 176 p.

Cassier, Co., Ltd., Louis. **Metals & Alloys: Tables Containing the Percentage Composition and Other Particulars of Over 3700 Metals and Alloys.** Ed. 4. Company, London, 1941, 156 p.

Funk, Herbert. **Die Darstellung der Metalle im Laboratorium.** Enke, Stuttgart, 1938, 183 p.

Hibben, Thomas. **The Sons of Vulcan: the Story of Metals.** J. B. Lippincott & Co., Philadelphia, 1940, 259 p.

Hoyt, S. L. **Metals and Alloys Data Book.** Reinhold Publishing Corp., New York, 1943, 334 p.

Judge, A. W. **Engineering Materials.** Ed. 2. I. Pitman & Co., London, 1943, v. 1-2.

Merlub-Sobel, Menahem. **Metals and Alloys Dictionary.** Chemical Publishing Co., Brooklyn, N. Y., 1944, 238 p.

Römpp, Hermann. **Chemie der Metalle.** Franckh, Stuttgart, 1941, 229 p.

Standard Metal Directory. Ed. 8. Atlas Publishing Co., New York, 1940.

Standard Metal Directory. Ed. 9. Atlas Publishing Co., New York, 1943.

Standard Metal Directory. Ed. 10. Atlas Publishing Co., New York, 1946.

Thompson, M. de Kay. **The Total and Free Energies of Formation of the Oxides of 32 Metals.** Electrochemical Society, New York, 1942, 89 p.

Woldman, N. E. **Engineering Alloys: Names, Properties, Uses.** American Society for Metals, Cleveland, 1936, 622 p. (With A. J. Dornblatt.)

Woldman, N. E. **Engineering Alloys: Names, Properties, Uses.** Ed. 2. American Society for Metals, Cleveland, 1945, 801 p. (With R. J. Metzler.)

Classification Scheme

I. Metallurgy (in General)

(A) Process Metallurgy

1. Ore Dressing
2. Pyrometallurgy, Hydrometallurgy, Electrometallurgy
3. Furnaces, Refractories, Fuels, Slags, Temperature, Pyrometry

(B) Physical Metallurgy

1. Structure and Properties of Metals and Alloys
   (a) Phase Relations
2. Metallography
   (a) Microscope, Polishing, Etching
   (b) X-Ray Analysis, Radiography
3. Heat Treating
4. Testing and Mechanical Properties
5. Corrosion and Oxidation

(C) Mechanical Metallurgy

1. Powder Metallurgy
2. Casting
   (a) Pattern, Molds, Foundry Sands
3. Welding and Cutting
   (a) Electric
   (b) Gas
   (c) Soldering
4. Other Processes: Forging, Rolling, Extrusion, Drawing, Stamping, Spinning, Machining
5. Surface Treatment
   (a) Plating, Galvanizing
   (b) Enameling, Coloring, Spraying
   (c) Others

II. Metals (in General)

(a) Analysis

(A) Ferrous

(a) Biography, Economics, History

1. Iron
   (a) Cast
   (b) Iron and its Alloys
2. Steel
   (a) Special Steels

(B) Nonferrous

1. Aluminum, Magnesium
2. Brass, Bronze, and Bearing Metals
3. Copper
4. Gold, Silver, Platinum, and Other Precious Metals
5. Other Nonferrous Metals and Alloys

(a) Analysis

Allport, N. L. **Colorimetric Analysis.** Chapman & Hall, Ltd., London, 1945, 452 p.

American Society for Testing Materials. **A.S.T.M. Methods of Chemical Analysis of Metals.** Society, Philadelphia, 1936, 254 p.

American Society for Testing Materials. **A.S.T.M. Methods of Chemical Analysis of Metals.** Society, Philadelphia, 1943, 323 p.

American Society for Testing Materials. **A.S.T.M. Methods of Chemical Analysis of Metals.** Society, Philadelphia, 1946, 402 p.

Cartwright, Walter, Collier, T. W. and Charlesworth, A. **Analysis of Nonferrous Metals and Alloys.** C. Griffin & Sons, London, 1937, 296 p.

Compagno, I. **Analisi dei metalli non ferrosi; di uso industriale e delle loro leghe.** Ulrico Hoepli, Milan, 1939, 494 p.

Feigl, Fritz. **Laboratory Manual of Spot Tests.** Translated from the German by R. E. Oesper. Academic Press, Inc., New York, 1943, 276 p.

Feigl, Fritz. **Qualitative Analysis by Spot Tests, Inorganic and Organic Applications.** Ed. 2, translated by J. W. Matthews. Nordemann Publishing Co., New York, 1939, 462 p.

Gibb, T. R. P., Jr. **Optical Methods of Chemical Analysis.** McGraw-Hill Book Co., Inc., New York, 1942, 391 p.

Gregory, Edwin and Stevenson, W. W. **Chemical Analysis of Metals and Alloys.** Chemical Publishing Co., New York, 1938, 375 p.

Haywood, F. W. and Wood, A. A. R. **Metallurgical Analysis by Means of the Spekker Photo-Electric Absorptiometer.** Adam Hilger, Ltd., London, 1944, 128 p.

Heyrovsky, Jaroslav. **Polarographie. Theoretische Grundlagen praktische Ausfuhrung und Anwendungen der Elektrolyse mit der tropfenden Quecksilberelektrode.** Springer Verlag, Wien, 1941, 514 p.

Hills, F. G. **Technical Analysis of Ores and Metallurgical Products.** Chemical Publishing Co., New York, 1937, 198 p.

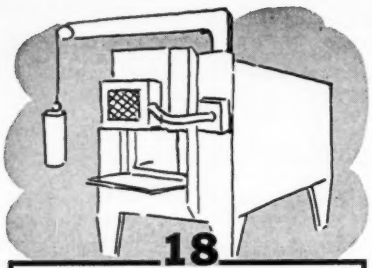
Hopkin & Williams, Ltd., London. Research Laboratory. **Organic Reagents for Metals and for Certain Acid Radicals.** Ed. 4. Company, London, 1943, 176 p.

Kershner, K. K. **Qualitative Chemical Analysis of the Metals.** Rev. Ed. J. S. Swift, St. Louis, Mo., 1939.

Kolthoff, I. M. and Lingane, J. J. **Polarography: Polarographic Analysis and Voltammetry, Amperometric Titrations.** Interscience Publishers, Inc., New York, 1941, 510 p.

Mellon, M. G. **Colorimetry for Chemists.** G. Frederick Smith Chemical Co., Columbus, Ohio, 1945, 133 p.

(*Turn to page* 35)



18 HEAT TREATMENT

18b—Ferrous

18b-119. La nitruration. (Nitriding) H. Wiegand. *Revue de Métallurgie,* v. 45, March-April 1948, p. 105-117.

The process of nitriding of steel and its advantages for improving its mechanical properties. Effects on various types of machine parts. Comparative properties of various alloy steels with and without nitriding.

18b-120. The Properties of Oils Used in the Heat-Treatment of Steel. G. T. Dunkley. *Metal Treatment and Drop Forging,* v. 15, Summer 1948, p. 67-72.

Some practical notes on the selection of quenching oils for hardening steel, showing that viscosity is the most important property and emphasizing the desirability of controlling the temperature of the quenching bath. Properties necessary in tempering oils.

18b-121. Heat Treatment of Carbon and Alloy Steels for Vehicles and Engines. D. C. G. Lees. *Metal Treatment and Drop Forging,* v. 15, Summer 1948, p. 73-74

Carburizing, quenching, salt baths and oil tempering, and control.

18b-122. Heat Treatment of Gray Iron; Basic Principles and Practical Applications. *Canadian Metals & Metallurgical Industries,* v. 11, Aug. 1948, p. 17-18, 42.

Reviews three papers covering various phases of the above subject, presented at 52nd annual A.F.S. meeting, Philadelphia.

18b-123. Automatic Heat-Treatment and Inspection of Ball Bearings. *Machinery* (London), v. 73, Aug. 26, 1948, p. 313.

French arrangement is briefly described and diagrammed.

18b-124. Heat Treatment: Conventional and Isothermal. *SAE Journal,* v. 56, Sept. 1948, p. 18-21. Based on "Principles and Application of Isothermal Heat Treatment," by J. M. Hodge. (To be published in full in *SAE Quarterly Transactions.)*

Fundamental principles and advantages of isothermal treatment and a series of time-temperature diagrams on which cooling curves for the two different types of hardening, annealing, and normalizing are superimposed on the isothermal transformation diagram.

18b-125. New Developments in Tool Steels. Part III. George A. Roberts. *Tool & Die Journal,* v. 14, Sept. 1948, p. 62, 64-66, 68.

Use of tempering charts, bainitic treatments, bend tests, and carburization of high speed steel.

18b-126. Studies Factors Affecting Stabilization of Stainless Steels. *Steel,* v. 123, Sept. 6, 1948, p. 119.

Results of a study of factors affecting the stabilization of 18-8 stainless steels to determine the relative amounts of Ti and Cb necessary for effective stabilization, the injurious effects of carbon content, and the necessity for stabilizing heat treatments. The research was conducted for the Bureau of Aeronautics, Navy Department, by the National Bureau of Standards.

18b-127. Controlled Atmosphere Cycle Annealing. Thomas A. Frischman. *Iron Age,* v. 162, Sept. 9, 1948, p. 72-77.

Simultaneous cycle annealing of up to eight different grades of low to medium-carbon alloy steels, producing in each steel a good machinable structure. Construction of the five-zone controlled atmosphere furnace used; and details of the "all purpose" cycle, fuel and power consumption, atmospheres, types of steel annealed, and structures and hardness obtained.

18b-128. Fatigue Tests on Crankshaft Steels. Part I. The Effect of Nitriding on the Fatigue Properties of a Chromium-Molybdenum Steel. *Journal of the Iron and Steel Institute,* v. 159, Aug. 1948, p. 385-400.

Tests showed that after nitriding for 10, 22, or 72 hr. at 485° C., fatigue fractures commenced in the vicinity of the junction between the case and the core; but with nitrided, hollow specimens with oil-hole, fractures commenced on the surface of the nitrided case. It was calculated that by nitriding crankshafts and airscrew shafts for 10 instead of 72 hr. at 485° C., a reduction in fatigue limit of approximately 0.7% would be obtained for sections approximately 3.0 in. in diameter without any form of stress concentration, while the fatigue limit of the oil-hole sections of the components would be slightly increased. 12 ref.

18d—Light Metals

18d-12. Observations on the Annealing Characteristics of an Aluminium-Copper-Magnesium Alloy. Maurice Cook and T. Ll. Richards. *Journal of the Institute of Metals.* v. 74, July 1948, p. 583-597.

Isochronal annealing curves of a 4%-Cu, 0.7%-Mg aluminum alloy show, after a slight initial hardening with increasing temperature, softening in two distinct stages, followed by an increase in hardness. A study of the influence of rolling and annealing conditions revealed that the initial hardening is associated with age hardening and that the two softening stages are accompanied by two structural changes, corresponding to recovery and recrystallization and confirming the belief that softening on annealing is a two-stage process. The curve for the alloy in the nonaging condition shows a lowering of the recrystallization temperature and no initial hardening.

18d-13. Tempering Oils for Aging 75 S Aluminum Alloys. S. H. Phillips. *Industrial Heating,* v. 15, Sept. 1948, p. 1488, 1490, 1492, 1494, 1496, 1498.

Recommended equipment and oils. Meanings of the various temper designations: 75 SO, 75S-AQ, 75 SW, and 75 ST, and pointing out the difference between 75 ST and 24 ST.

For additional annotations indexed in other sections, see:

27a-127.

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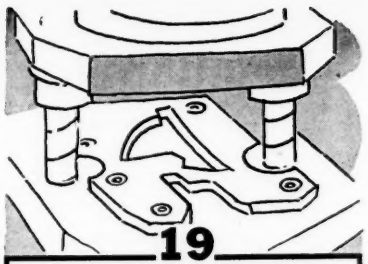

19 WORKING

19a—General

19a-185. True Stress-Strain Curves and Their Application to Cold-Working Processes. E. Voce. *Metal Treatment and Drop Forging,* v. 15, Summer 1948, p. 53-66, 72.

Relation between strain and true stress—the stress at any stage during deformation, expressed in terms of the actual area of the specimen at that stage. Some simple principles are worked out and applied to wire drawing, rolling, deep drawing and cupping tests.

19a-186. The Relationship Between Stress and Strain for Homogeneous Deformation. E. Voce. *Journal of the Institute of Metals,* v. 74, July 1948, p. 537-562.

A simple relationship connecting stress with strain for a series of homogeneous compression curves published by Cook and Larke. The plastic modulus at any instant is proportional to the available stress capacity. The same relationship appears to hold for tension as well as for compression as long as the deformation remains homogeneous. The concepts are admitted to be speculative in character and to be based on limited experimental evidence.

19a-187. Note on a New Method for Checking the Profile of Wire-Drawing Dies. J. G. Wistreich. *Engineers' Digest,* v. 5, July 1948, p. 263.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Part 4, April 1948, p. 496. See item 19a-97, 1948.

19a-188. Designing of "Trouble-Free" Dies. Part 84. Types of Presses, Their Uses and Capacities. C. W. Hinman. *Modern Industrial Press,* v. 10, Aug. 1948, p. 20, 42.

19a-189. The Art of Rolling Hexagons and Octagons. Charles P. Hammond. *Iron and Steel Engineer,* v. 25, Aug. 1948, p. 37-49; discussion, p. 49-50.

Although modern mills and equipment produce tonnages and quality which previously would have seemed impossible, rolling procedures and principles are fundamental.

19a-190. Drives For Automatic Speed and Tension Control In Wire Processing Equipment. Part II. N. J. Ranney. *Wire and Wire Products,* v. 23, Sept. 1948, p. 763-768, 802-803.

Details of mechanical and hydraulic drives and their applications.

19a-191. Die Design for Symmetrical Brackets. Part I. Hans Effgen. *Tool & Die Journal,* v. 14, Sept. 1948, p. 51-56.

Calculations and blueprint-type diagrams.

19a-192. Why Hydraulic Presses? Part III. Herbert Chase. *Tool & Die Journal,* v. 14, Sept. 1948, p. 57-59.

Advantages over other types.

(Turn to page 36)

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Niezoldi, Otto. **Ausgewählte, chemische Untersuchungsmethoden fur die Stahl und Eisenindustrie.** Ed. 2. J. Springer, Berlin, 1939, 175 p.

Niezoldi, Otto. **Ausgewählte, chemische Untersuchungsmethoden fur die Stahl und Eisenindustrie.** Ed. 3. J. Springer, Berlin, 1942, 184 p.

Pigott, E. C. **The Chemical Analysis of Ferrous Alloys and Foundry Materials: Modern Practice and Theory.** Chapman & Hall, Ltd., London, 1942, 362 p.

Sandell, E. B. **Colorimetric Determination of Traces of Metals.** Interscience Publishers, Inc., New York, 1944, 487 p.

Smith, D. M., ed. **Collected Papers on Metallurgical Analysis by the Spectrograph.** British Non-Ferrous Metals Research Association, London, 1945, 162 p.

Twyman, Frank. **The Spectrochemical Analysis of Metals and Alloys.** Chemical Publishing Co., Inc., Brooklyn, N. Y., 1941, 355 p.

United States Steel Corp. **Sampling and Analysis of Carbon and Alloy Steels.** Reinhold Publishing Corp., New York, 1938, 356 p.

Verein Deutscher Eisenhuttenleute. **Chemikerausschuss Analyse der Metalle. v. 1. Schiedsverfahren.** J. Springer, Berlin, 1942, 506 p.

Weihrich, Robert. **Die chemische Analysie in der Stahlindustrie.** Ed. 3. Enke, Stuttgart, 1942, 244 p.

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A. Ferrous

(In General)

Allison, Archibald. **Outline of Steel and Iron.** Sherwood Press, Cleveland, 1937, 191 p.

Boylston, H. M. **An introduction to the Metallurgy of Iron and Steel.** Ed. 2. J. Wiley & Sons, Inc., New York, 1936, 563 p.

Bray, J. L. **Ferrous Production Metallurgy.** John Wiley & Sons, Inc., New York, 1942, 457 p.

Durrer, Robert. **Erzeugung von Eisen und Stahl.** Steinkopff, Dresden, Leipzig, 1936, 159 p.

Fielding, John. **The Ferrous Metals; Methods of Manufacture, Fabrication and Heat Treatment.** Burgess Publishing Co., Minneapolis, Minn., 1938, 164 p.

Ihrig, H. K. **Outline of the Metallurgy of Iron and Steel.** Ed. 3. Globe Steel Tubes Co., Milwaukee, Wis., 1941, 80 p.

Jacquet, Alexis. **Aciers, fers, fontes.** Ed. 3. Dunod, Paris, 1938, 2 v.

Oberhoffer, Paul. **Das technische Eisen; Konstitution und Eigenschaften.** Ed. 3. J. Springer, Berlin, 1936, 642 p.

Piccininni, Antonio. **Fabricazione ghisa e acciaio.** Ulrico Hoepli, Milan, 1938, 411 p.

Rosenholtz, J. L. and Oesterle, J. F. **Elements of Ferrous Metallurgy.** Ed. 2. John Wiley & Sons, Inc., New York, 1938, 258 p.

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19a-193. Metal Stampings For Ordnance Held to be Answer to Many Needs of Armed Forces. *Steel,* v. 123, Sept. 6, 1948, p. 120, 140. Based on address by Howard C. Wolf.

Recommends more consideration of stampings to save raw material and reduce production costs. Processes of cold forming, deep drawing, and cold extrusion; also new fields for alloy steel.

19a-194. The Effect of Crystal Arrangement on "Secondary Recrystallization" in Metals. J. S. Bowles. *Journal of the Institute of Metals,* v. 74, June 1948, p. 501-519.

The effects on secondary recrystallization of the amount of deformation and of the mode of arrangement of the crystals were separated by studying this phenomenon in specimens which had been given the same amount of deformation by straight rolling and compression rolling. Straight-rolled specimens possessed the usual type of preferred orientation, while the compression-rolled specimens possessed fibrous structures. The work was done using copper, silver, and two grades of aluminum. 23 ref.

19a-195. A New Theory of the Plastic Deformation in Wire-Drawing. R. Hill and S. J. Tupper. *Journal of the Iron and Steel Institute,* v. 159, Aug. 1948, p. 353-359.

New theory proposed differs from previous work in that the stresses and the plastic region are determined by considerations of the associated deformation. The theory is based on a two-dimensional model which gives results close to actual experience. 11 ref.

19a-196. Fundamentals of Forging Practice. VII and VIII. Waldemar Naujoks. *Steel,* v. 123, Aug. 30, 1948, p. 59-64, 86; Sept. 13, 1948, p. 100-103, 126.

Of the many factors important to the practical application of forging techniques, none is more essential than the correct construction of die blocks and tools. Selecting steels, laying out, sinking the impression, pouring the lead proof, shrink rules, finish machining. Facilities for performing various nonforging services such as cutting bars and billets, trimming and punching, coining and sizing, which must be available in any efficient forging plant.

19a-197. Production Processes—Their Influence on Design. Part XXXVII. Cold Drawing. Roger W. Bolz. *Machine Design,* v. 20, Sept. 1948, p. 129-134.

Procedures and design principles.

19a-198. A Law of Work-Hardening. A. M. Fruedenthal and M. Reiner. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 265-273.

Based on the "blocking" theory of the strength of a polycrystalline metal, a law of work-hardening was derived and checked experimentally on mild steel deformed by wire drawing. The law correlates the recoverable strain work with the total work of deformation in a series of exponential functions, the number of which corresponds to the number of sizes of crystal grains present in the annealed state. 13 ref.

19a-199. Contact Stresses in the Rolling of Metals. I. C. W. MacGregor and R. B. Palme. *Journal of Applied Mechanics,* v. 15. *(Transactions of the American Society of Mechanical Engineers,* v. 70), Sept. 1948, p. 297-302.

Special equipment was designed and constructed to investigate the distributions of the normal pressures and the longitudinal and transverse shearing stresses along the arc of contact during the rolling of metals between plain cylindrical rolls. 14 ref.

19b—Ferrous

19b-105. Interesting Stamping Operations at Norris Stamping and Manufacturing Co. Gerald Eldridge Stedman. *Machine and Tool Blue Book,* v. 44, Sept. 1948, p. 113-118.

The deep drawing of square washing-machine tubs and fabrication of collapsible spouts.

19b-106. Output of Tin Plate Gages Increased 74 Per Cent by Use of Forged Sleeves on Back-Up Rolls. *Steel,* v. 123, Sept. 6, 1948, p. 111, 128, 130.

19b-107. Progressive Die Scores, Trims and Forms Heavy Shell. Theodore Oshinsly. *American Machinist,* v. 92, Sept. 9, 1948, p. 85.

Six-in. shell is made from 0.109-in. thick C.R. steel half-hard temper.

19b-108. Rolling Screw Spikes. *Fasteners,* v. 5, No. 2, (1948), p. 14-15.

The development of satisfactory dies for rolling these screw spikes, during which numerous difficulties were encountered.

19b-109. High Creep Strength Austenitic Steel Tubes. G. T. Harris and W. H. Bailey. *Metallurgia,* v. 38, Aug. 1948, p. 189-192.

The development of heat-resisting steel tubes for use in heat exchangers for gas turbines. Manufacturing procedure, mechanical properties, structure, and welding.

19b-110. Producing Wide Stainless-Steel Sheets at Republic Steel Corporation's New Plant. *Machinery,* v. 55, Sept. 1948, p. 205-206.

Processes include cold reducing, annealing, pickling, and slitting and cutting.

19b-111. Automatic Spinning of Stainless Steel. Arnold Hildebrandt. *Tool Engineer,* v. 21, Sept. 1948, p. 20-22.

Procedure for production of cones for television cathode-ray tubes from Type 446 stainless steel.

19c—Nonferrous

19c-20. Verfestigte Bleibronzen. (High-Strength Lead Bronzes.) B. Garre. *Archiv fur Metallkunde,* v. 1, Sept. 1947, p. 408-412.

Experiments showed that hardness and tensile strength of the above can be greatly increased by cold working. Practical methods for strengthening lead-bronze bearings and the structural changes which occur during the process.

19c-21. The Effect of Cold Working on the Magnetic Properties of Pure Metals. James Reekie and T. S. Hutchison. *Physical Review,* ser. 2, v. 74, Sept. 1, 1948, p. 610-620.

This strain sensitivity of susceptibility cannot be accounted for by the presence of ferromagnetic impurities, but appears to be related to certain metallurgical changes which occur on cold working. A plausible explanation is proposed. 19 ref.

19d—Light Metals

19d-46. Developments in the Deep-Drawing of Magnesium. *Magazine of Magnesium,* Aug. 1948, p. 5.

19d-47. Forging Aluminum Alloys. M. Chartron. *Metal Industry,* v. 73, Aug. 6, 1948, p. 107-110, 113; Aug. 13, 1948, p. 131-133; Aug. 20, 1948, p. 149-150. Translated from *Revue d'Aluminium.*

Results of an investigation, and fundamental factors involved.

19d-48. Flow Control by Blankholder Pressure. J. W. Lengbridge. *Tool Engineer,* v. 21, Sept. 1948, p. 23-26.

Installment No. 4 of a series on the theory and practice of pressing aluminum.

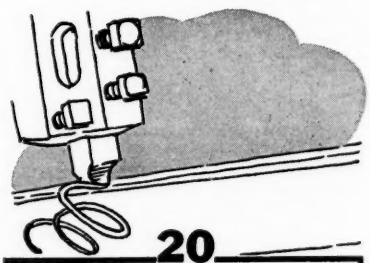
19d-49. Magnesium Parts May Be Hot-Formed From Sheet to Produce Deep Draws Economically in One Operation. *Machine Design,* v. 20, Sept. 1948, p. 143-146.

Procedures.

19d-50. "Pre-Stretches"—Forms. *Steel,* v. 123, Sept. 20, 1948, p. 102.

New machines for stretching and forming Al-alloy sheets.

For additional annotations indexed in other sections, see: 4d-25; 16b-78-81; 22a-184; 24a-201; 27a-127.



20 MACHINING and MACHINABILITY

20a—General

20a-333. Theory of Cutting of Prof. K. A. Zvorykin and "New" Theory of M. E. Merchant. (In Russian.) A. V. Pankin. *Stanki i Instrument.* (Tools and Instruments), v. 19, April 1948, p. 1-3.

After comparative investigation of Zvorykin's theory (published in 1892) and Merchant's theory (developed in 1944), the author concludes that the latter theory is the same as the former, with only slight modifications.

20a-334. Physicochemical Action of Cutting Oils During the Machining Process. (In Russian.) F. A. Bashkirev. *Stanki i Instrument.* (Tools and Instruments), v. 19, April 1948, p. 17-22.

Effect of cutting oils on machining and results of investigation of a series of 29 cutting oils of various compositions used in the U.S.S.R., as applied to different types of machining.

20a-335. A Five-Way Tapping Machine. *Machinery Lloyd* (Overseas Edition), v. 20, July 31, 1948, p. 109.

Single-purpose machine for tapping of electric conduit boxes at a production rate of from three to four boxes per minute.

20a-336. Lapping to One Millionths. R. G. Roshongs. *Western Machinery and Steel World,* v. 39, Aug. 1948, p. 108-110.

A machine for producing a finish so incredibly fine that it must be measured by standards that are 1000 times as accurate as would be necessary for ordinary grinding processes.

20a-337. Lathe Fixture for Pointing Spindles. *Machinery* (London), v. 73, Aug. 5, 1948, p. 150-151.

Fixture designed for use in machining conical points on cylindrical spindles.

20a-338. Die-Casting Dies. (Concluded.) W. M. Halliday. *Metal Industry,* v. 73, Aug. 6, 1948, p. 111-113.

Methods of eliminating machining faults.

20a-339. Involute Gear Hobbing Cutters. F. G. Watts. *Machinery* (London), v. 73, Aug. 12, 1948, p. 171-178.

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Osann, Bernhard. **Kurzgefasste Eisenhuttenkunde in Leichtverstandlicher Darstellung fur Ingenieure, Techniker und Studierende des Eisenfachs.** Ed. 3. Max Janecke, Leipzig, 1943, 231 p.

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Roll, Franz. **Eisen und Eisenlegierungen.** J. J. Arnd, Leipzig, 1939, 102 p.

Roll, Franz. **Eisen und Eisenlegierungen.** E. 2. J. J. Arnd, Leipzig, 1942, 111 p.

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(a) Cast

Allen, R. M. **The Microscope in Elementary Cast Iron Metallurgy.** American Foundrymen's Association, Chicago, 1939, 143 p.

American Foundrymen's Association. Gray Iron Division. Alloy Cast Iron Committee. **Alloy Cast Irons.** Association, Chicago, 1939, 257 p.

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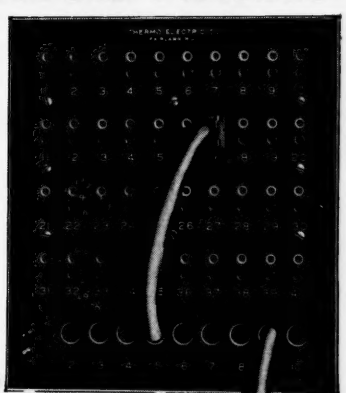

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Details of the development of proper designs.

20a-340. Set-Ups for Grinding Milling Cutters. *Machinery* (London), v. 73, Aug. 12, 1948, p. 179-185.

Methods recommended by Brown & Sharpe for various types.

20a-341. The Machine Tool & Engineering Exhibition. *Machinery.* (London), v. 73, Aug. 19, 1948, p. 199-251.

Equipment exhibited at British show which opened Aug. 26: lathes and boring mills; grinding and honing machines; milling machines; drilling and boring machines; gear cutting and finishing machines; sawing and cutting-off machines; presses and hammers; and planing, shaping, and slotting machines.

20a-342. Large Versus Small Hobs. *Machinery* (London), v. 73, Aug. 19, 1948, p. 253-254. Based on B.I.O.S. Final Reports Nos. 442 and 642.

Results of investigation of some large hobs found in Germany by an intelligence team. As a result of a series of tests, the investigators concluded that there is no evidence that the large hob is appreciably superior to a hob of normal size run at the same cutting speed, although it may be expected to have a proportionately longer life between successive resharpenings owing to its larger number of cutting edges.

20a-343. The Machine Tool & Engineering Exhibition. *Machinery* (London), v. 73, Aug. 26, 1948, p. 265-310.

Representative machines are described in greater detail under the headings: lathes and boring mills; grinding and honing machines; milling machines; drilling and boring machines; gear cutting and finishing machines; planing and shaping machines; presses and hammers; sawing and cutting-off machines; and miscellaneous machines.

20a-344. Setting Device for Grinding Wheel Truing Diamond. *Machinery* (London), v. 73, Aug. 26, 1948, p. 313.

Simple device for setting a truing diamond in correct relation to the grinding wheel and work centers.

20a-345. "All-Depth" Drills for Shallow and Deep Hole Drilling. Part II. Fred W. Lucht. *Tool & Die Journal,* v. 14, Sept. 1948, p. 78-81.

See abstract of "Design and Application of Carbide-Tipped All-Depth Drills," *Machinery,* v. 54, June 1948, p. 156-160. Item 20a-227.

20a-346. Safe Operation of Portable Grinders. R. B. Fair. *Foundry,* v. 76, Sept. 1948, p. 86-89, 166.

Factors to consider in use of various grinders.

20a-347. The Use and Operation of Single and Multiple Spindle Automatics. Ralph A. Warren. *Machine and Tool Blue Book,* v. 44, Sept. 1948, p. 133-136, 138, 140.

First of a series pertaining to cams, tools, etc., for use with single and multispindle automatic screw machines. This installment deals with the Brown & Sharpe machines.

20a-348. Multiple Milling Fixtures for Medium-Sized Runs. Robert Mawson. *Production Engineering & Management,* v. 22, Sept. 1948, p. 57-58.

How a six-position, indexing-milling fixture, designed for progressive positioning of the workpiece, can be modified to suit a wide range of milling operations.

20a-349. The Crib. Ideas—Kinks—Short Cuts. *Production Engineering & Management,* v. 22, Sept. 1948 p. 75.

"Removing Drill Chucks", by Ben M. Fleek; "An Emergency Drill Jig", by W. M. Goodrich.

20a-350. Practical Ideas. *American Machinist,* v. 92, Sept. 9, 1948, p. 124-128.

Die mechanism for force fitting balls onto handles (Joseph F. Budnick); tooling methods for producing reinforcing bands for chimneys (J. J. Reich); use of pre-parting punch for manufacture of tear-drop-shaped sheet-metal shape (Alexander Maxwell); sawtooth jig aligns drill for machining slots (H. Moore); turning steam fitting accurately with ball-and-socket spacer bar (W. D. Stevens); turning flat circular disks too thin to grip by edges (George E. Caple); fixture to check form-tool grind (Bruce J. De Neve); and other miscellaneous shop hints.

20a-351. Milling Fixture Design Promotes Accuracy, Cuts Lost Motions. Robert Mawson. *Steel,* v. 123, Sept. 13, 1948, p. 122, 148.

Means of positioning workpiece made movable to compensate for changes in contour of casting or forging on which no finished surfaces can be used for locating tool.

20a-352. New Diamond Wheel Recommendations for Carbide Grinding. F. J. Benn. *Grits and Grinds,* v. 39, Aug. 1948, p. 1-5.

Selection of bond grit size, grade or hardness, diamond concentration, operating hints, and table of wheel recommendations.

20a-353. How Much Should Flange Screws be Tightened? What is the Proper Wrench Pull? A. O. Rousseau. *Grits and Grinds,* v. 39, Aug. 1948, p. 6-9.

Excessive tightening of above when mounting grinding wheels is said to be more common and more harmful than not tightening enough. Results of some experiments on a particular type of wheel and machine, and extends general recommendations for all types.

20a-354. New Machines for Sharpening Milling Cutters. *Industrial Diamond Review,* new series, v. 8, Aug. 1948, p. 243-245.

Swiss and American machines.

20a-355. The Use of Special Form Gear Shaper Cutters. *Machinery Lloyd* (Overseas Edition), v. 20, Aug. 28, 1948, p. 102-104.

20a-356. Sharpening Carbide Tools. Charles H. Wick. *Machinery,* v. 55, Sept. 1948, p. 180-184.

Relative merits of wet and dry grinding; coolants, speeds, and feeds used; and recommended methods for sharpening single-point carbide tools and grinding chip-breakers.

20a-357. Ingenious Fixture Used in Broaching Windows in Bearing Cages. *Machinery,* v. 55, Sept. 1948, p. 195.

Six windows or openings are broached in ball-bearing retainer cages by use of the fixture shown.

20a-358. Tool Engineering Ideas. *Machinery,* v. 55, Sept. 1948, p. 202-204.

Special Nose Type Chuck for a Solid-Spindle Lathe, Donald A. Baker; Quick-Acting Fixture Designed for Double Counterboring, Robert Mawson; and Die Set for Perforating Sheet Metal, Harold E. Murphey.

20a-359. Milling-Drilling Attachment Saves Handling. F. J. McArthur. *Tool Engineer,* v. 21, Sept. 1948, p. 30.

Milling-drilling fixture designed for supplementary machining operations on center and back bars for Fay automatic lathes speeds output and conserves floor space.

20a-360. The "How" of Machining Large Work. E. K. Morgan. *Tool Engineer,* v. 21, Sept. 1948, p. 31-33.

Several ingenious arrangements for using standard equipment with standard attachments for machining unwieldy work.

20a-361. Cutting and Horsepower Formula and Chart. *Tool Engineer,* v. 21, Sept. 1948, p. 34-35.

Chart allows determination of cu. in. of material removed per min. in relation to surface speed, depth cut, feed, and material diameter, also horsepower constants. Table of power constants recommended for average work and instructions for use of the chart.

20a-362. The Fundamentals of Tool Engineering. II. Cutting Tools for Engine Lathes. A. E. Rylander. *Tool Engineer,* v. 21, Sept. 1948, p. 39-40.

20a-363. Gadgets. *Tool Engineer,* v. 21, Sept. 1948, p. 41-42.

Lock for Geneva Index Table, C. W. Frank; Clamp for Right Angle Work, Clifford T. Bower; Retractible Locating Pin, John J. Boe; Plunger to Eject Work, James Maltby.

20b—Ferrous

20b-62. High Speed Planing with Carbide Tools. *Machinery* (London), v. 73, Aug. 12, 1948, p. 170.

The successive steps in a systematic investigation of the causes of tool failure and their elimination, resulting in the obtaining of speeds of 240 to 310 ft. per. min., with depths of cut, on semisteel castings, of 1/4 to 1 in. and feeds from 0.045 to 0.125 in.

20b-63. Shear Cutting Speeds Production of Motor Shafts. P. H. Foley and H. L. Seekin. *Machine and Tool Blue Book,* v. 44, Sept. 1948, p. 121-122, 124, 126, 128, 130.

In the shear-cut process, the shaft being machined is revolved slowly, while a formed broach is fed across the shaft on a tangent line.

20b-64. Lathe Facing Fixture Jumps Percentage of Production Time. Robert Mawson. *Steel,* v. 123, Sept. 6, 1948, p. 122.

How single-motion holding action reduces nonproductive time to a minimum, locates parts accurately and holds them rigidly in production of cast-iron traverse-bar lever driver used in textile machines.

20b-65. Friction Circular Sawing. *American Machinist,* v. 92, Sept. 9, 1948, p. 141, 143.

Process, and numerical data for ferrous metals.

20b-66. Tooling for High Production on Automatic Grinding Machines. *Machinery,* v. 55, Sept. 1948, p. 158-162.

Methods used in setting up "consta-contac" high-speed automatic grinding machines for production of ball and roller bearing races, automotive-engine valves, valve seats, pistons, and cast socket wrenches.

20b-67. Advanced Machining and Welding Methods in a Car-Building Shop. *Machinery,* v. 55, Sept. 1948, p. 163-165.

Car-wheel boring machines with rotating tools, hydraulic lathes that simultaneously rough- and finish-turn axles, and a huge spot welder are among the new machine tools developed by Pullman-Standard.

20b-68. Planing Cast Iron With Carbide Tools. George J. Raible. *Machinery,* v. 55, Sept. 1948, p. 171-173.

Recommended methods.

20b-69. Making Micrometer Dials for Machine Tools. George Black. *Machinery,* v. 55, Sept. 1948, p. 189-190.

Specially designed equipment for producing the above from "Stainless W," a Ti-bearing, age hardening, 18-8 stainless steel.

20c—Nonferrous

20c-9. Grinding of Beryllium Bronze. Robert Gadeau and Rene Schweyc-

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Piwowarsky, E. **Hochwertiges Gusseisen; seine Eigenschaften und die physikalische Metallurgie seiner Herstellung.** J. Springer, Berlin, 1942, 1005 p.

(b) Iron and its Alloys

Cornelius, Heinrich. **Kupfer im technischen Eisen.** J. Springer, Berlin, 1940, 225 p.

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A-2. Steel

(In General)

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(a) Special Steels

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(*Turn to page* 41)

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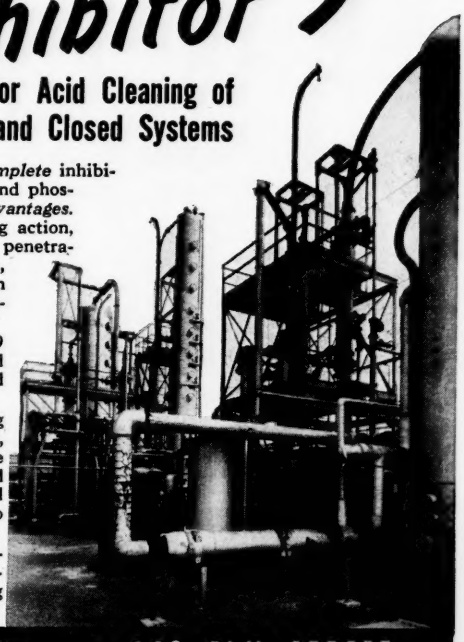

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kart. *Microtecnic* (English edition), v. 11, June 1948, p. 104-108. (Translated from the French).

Experimental study using cast beryllium bronze in the quenched, partly hardened, and hardened conditions. Plain cylindrical grinding and screw grinding were applied, the former with a soluble oil as a coolant, and also without coolant (dry grinding). Charts show the surface profiles obtained by different methods.

20c-10. Multi-Slide Tooling for Westinghouse Terminal Clips. *Tool & Die Journal,* v. 14, Sept. 1948, p. 70-72, 74, 76.

Production of terminal clips for outdoor watt-hour meter sockets on U. S. Multi-Slide machines. These machines are equipped with a die head, a cut-off slide, and appropriate cutting and forming tools.

20d—Light Metals

20d-18. Obrabeni hliniku a jeho slitin. (Machining of Aluminum and Its Alloys.) Zdenek Zatloukal. *Hutnické Listy,* v. 3, April-May 1948, p. 120-126.

Optimum conditions for machining aluminum and its alloys.

20d-19. Machining Magnesium Motors. Willard W. Harvey. *Western Machinery and Steel World,* v. 39, Aug. 1948, p. 96-99.

Manufacture of a motorized timber saw.

20d-20. How to Machine and Finish Aluminum Alloy Castings. Floyd A. Lewis. *Steel,* v. 123, Sept. 6, 1948, p. 90-94, 142.

Recommendations for type of tool; tool-grinding practices; tool finish; cutting speeds and feeds; cutting compounds; salvage of cuttings; surface and mechanical finishing; sandblasting; chemical and electrochemical finishes; electroplating; and use of paints, lacquers, and enamels.

For additional annotations indexed in other sections, see:

22a-184; 24a-195; 27a-126; 27d-16.

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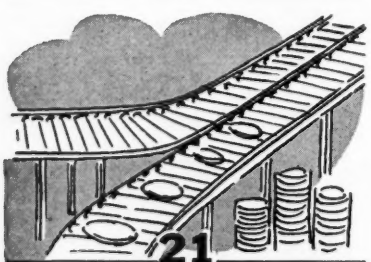

21 MISCELLANEOUS FABRICATION

21a—General

21a-127. The Production of Alarm Clock Components. *Machinery* (London), v. 73, July 29, 1948, p. 115-121.

Special equipment and methods employed at a Lanarkshire, England, factory.

21a-128. Ford Buys in the West. *Western Machinery and Steel World,* v. 39, Aug. 1948, p. 74-95.

Manufacturing experiences and procedures of the Ford Motor Co., at its western plants: Ford Buys in the West, L. C. Disser; Springs & Bumpers Since 1917, John B. Rauen, Jr.; Streamlining for Mass Production, Robert J. Cannon; Wheel Production, Kenneth T. Norris; Forging for Ford, James W. Sheehan; Automotive Rubber Parts, John B. Watson; Heading and Threading; Cold-Heading Specials for Ford, C. W. Hyden; Transfer Molded Rubber and Metal Inserts, T. L. Tafe; There is More Than Wire in Springs, Frank O. Holister; Mass Production is Our Business, W. T. Davis; and Hand Tools for Ford, Morris B. Pendleton.

21a-129. Modern Machines and Methods Speed Growth of York Corporation Cooling Units. P. D. Aird. *Modern Industrial Press,* v. 10, Aug. 1948, p. 13-14, 16, 48-49.

Special machines and fixtures; unusual applications of old and tested engineering principles; installation of the latest in dies and automatic handling equipment.

21a-130. Mobile Presses Produce Variety of Wares at Northwest Metal Products. Howard E. Jackson. *Modern Industrial Press,* v. 10, Aug. 1948, p. 30, 32, 34, 36.

Installations which enable above factory to complete all operations under one roof and on a high production scale.

21a-131. Automatic Production of Radio Equipment. *Machinery Lloyd* (Overseas Edition), v. 20, Aug. 14, 1948, p. 73-77.

Fully automatic methods used by a British firm.

21a-132. Producing the Seeburg Non-Stop Record Player. T. E. Lloyd. *Iron Age,* v. 162, Aug. 26, 1948, p. 86-92.

The incorporation of strength, light weight, and trouble-free and vibrationless operation into the new Seeburg Select-O-Matic "200" Library involved a careful selection of materials as well as ingenuity in design. Manufacture, material selection and construction.

21a-133. General Purpose vs. Special Purpose Machines for Mass Production. E. K. Morgan. *Production Engineering & Management,* v. 22, Sept. 1948, p. 51-56.

Graphically establishes the dividing line, based on product volume, for the economical use of general-purpose machines or line equipment.

21a-134. Mass Manufacture of Precision Made Parts: General Motors, Diesel Equipment Division, Grand Rapids, Michigan. *Production Engineering & Management,* v. 22, Sept. 1948, p. 59-66.

Equipment and procedures for machining, heat treatment, and inspection.

21a-135. Mass Producing 15-Ton Bulldozers. Walter J. Brooking. *Iron Age,* v. 162, Sept. 2, 1948, p. 82-86, 142.

Standardization of production methods and equipment and extensive utilization of arc welding are features of the planned production of bulldozers at Le Tourneau's new Longview, Texas, plant. Fixtures, jigs and holding devices for machining and welding assure uniformity of quality and optimum production.

21a-136. Aircraft Fixtures Make Trolley-Coach Assemblies. Seth C. Klein. *American Machinist,* v. 92, Sept. 9, 1948, p. 88-91.

Manufacture of trolley-coach bodies utilizing principles of stressed-skin construction perfected during the war by aircraft designers. Also adapted from the aircraft industry was the basic idea of constructing sidewalls, roof, and front and rear end subassemblies as completed units on fixtures set apart from the final assembly line.

21a-137. Air-Operated Tools in Power Shovel and Crane Assembly Lines. *Machinery,* v. 55, Sept. 1948, p. 191-192.

Uses at Thew Shovel Co., Lorain, Ohio.

21a-138. Automatic Hoppers Speed Assembling. A. E. Rylander. *Tool Engineer,* v. 21, Sept. 1948, p. 17-19.

Various types applicable to both similar and dissimilar parts.

21a-139. Auto-Lite's Flexible Setup. Joseph Geschelin. *Automotive Industries,* v. 99, Sept. 15, 1948, p. 26-28, 88, 90.

Equipment and procedures by which more than 800 variations of distributors and about 100 types of ignition coils are produced at Toledo plant. Machine-shop operations and finishing and plating procedures.

21b—Ferrous

21b-67. Diversified Applications of Stainless Clad Steel. L. W. Townsend. *Steel,* v. 123, Sept. 6, 1948, p. 95-96, 124, 126.

Fabrication and finishing procedure as well as applications.

21b-68. A New Type of Hollow Steel Propeller Blades. Kenneth Rose. *Automotive Industries,* v. 99, Sept. 1, 1948, p. 32-33, 86, 88.

Production by forming and welding. Weight savings are achieved by an unusual combination of materials and fabricating methods.

21b-69. Producing Wire for the Fastener Industry. J. R. Thompson. *Fasteners,* v. 5, No. 2, 1948, p. 16-19.

Methods used in manufacture of cold heading wire, recent innovations, scale removal, wire drawing, heat treating, and inspection.

21b-70. Spring Steels "Air Fabricated" at West Coast Automotive Parts Plant. *Steel,* v. 123, Sept. 20, 1948, p. 110, 113.

Use of compressed air for several operations in assembly and fabrication of leaf springs.

21d—LightMetals

21d-12. Hlinikova folie. (Aluminum Foil.) Bedrich Puchnar. *Hutnicke Listy,* v. 3, April-May 1948, p. 115-116.

Production and properties.

21d-13. Making the Functional Model in Magnesium. *Magazine of Magnesium,* Aug. 1948, p. 8-11.

Techniques for making prototypes or pilot models, and advantages.

For additional annotations indexed in other sections, see:

27b-39.

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METALLURGICAL BOOKS

Carnegie-Illinois Steel Corp. **Fabrication of U. S. S. Stainless Steels.** Rev. Ed. Corporation, Pittsburgh, 1946, 136 p.

Carnegie-Illinois Steel Corp. **Steel Aircraft Materials and Applications.** Corporation, Pittsburgh, 1942, 75 p.

Carnegie-Illinois Steel Corp. **U. S. S. Carilloy Steels.** Corporation, Pittsburgh, 1938, 214 p.

Climax Molybdenum Co. **Molybdenum in Steel.** Company, N. Y., 1938 (loose-leaf).

Copper Development Association. **Copper in Cast Steel and Iron.** Association, London, 1937, 136 p.

Emmons, J. V. **The Molybdenum-Tungsten High Speed Steel Marketed Under the General Trade Name Mo-Max.** Ed. 6. Cleveland Twist Drill Co., Cleveland, 1945, 59 p.

French, H. J. **Alloy Constructional Steels.** American Society for Metals, Cleveland, 1942, 294 p.

Gill, J. P., and Others. **Tool Steels.** American Society for Metals, Cleveland, 1944, 577 p.

Houdremont, Eduard. **Handbuch der Sonderstahlkunde.** J. Springer, Berlin, 1943, 1036 p.

International Nickel Co. Development and Research Department. **Nickel Alloy Steels (With Revisions).** Company, New York, 1939 (loose-leaf).

Khimushin, F. F. **Stainless Acid and Heat Resisting Steels.** (In Russian). Moscow, 1945, 479 p.

Kubasta, Josef. **Das Härteverhalten der Edelstähle.** W. Knapp, Halle, 1940, 188 p.

Miller, P. H. **Stainless Steels.** Oxford University Press, London, 1937, 95 p.

Palmer, F. R. **Tool Steel Simplified.** Carpenter Steel Co., Reading, Pa., 1937, 316 p.

Parker, C. M. **The Metallurgy of Quality Steels.** Reinhold Publishing Corp., New York, 1946, 248 p.

Rapatz, Franz. **Die Edelstähle.** Ed. 3. J. Springer, Berlin, 1942, 482 p.

Schmidt, Max. **Werkzeugstähle; Stähle fur Kalt und Warmarbeits-werkzeuge.** Verlag Stahleisen, Dusseldorf, 1943, 263 p.

Timken Roller Bearing Co. Steel & Tube Division. **Digest of Steels for High-Temperature Service.** Ed. 4. Company, Canton Ohio, 1939, 215 p.

Timken Roller Bearing Co. Steel & Tube Division. **Digest of Steels for High-Temperature Service.** Ed. 5. Company, Canton, Ohio, 1946, 215 p.

Timken Roller Bearing Co. Steel & Tube Division. **Timken Graphitic Steel.** Ed. 8. Company, Canton, Ohio, 1946, 48 p.

(To Be Continued)

Tube Turns Adds Subsidiary

In a program of steady expansion, Tube Turns, Inc., of Louisville, Ky., has acquired the Pennsylvania Forge Corp. in Tacony, a suburb of Philadelphia. The new subsidiary is a well-known manufacturer of flanges and custom forgings.

IMPORTANT MEETINGS

for November

Nov. 4-5—American Society for Quality Control. Third Midwest Quality Control Conference, Sherman Hotel, Chicago. (E. H. Robinson, American Society for Quality Control, 4949 West 65th St., Chicago 38.)

Nov. 4-5—Metals Casting Conference, Purdue University, Lafayette, Ind. (Sponsored by Purdue University in cooperation with the American Foundrymen's Society.)

Nov. 4-5—Society of Automotive Engineers. Fuel and Lubricants Meeting, Mayo Hotel, Tulsa, Okla. (John A. C. Warner, secretary and general manager, S.A.E., 29 West 39th St., New York 18.)

Nov.12—X-Ray and Electron Diffraction Conference, Room 14-202, General Motors Bldg., Detroit. (J. C. Kremer, physics instrumentation department, Research Laboratories Division, General Motors Corp., P. O. Box 188, North End Station, Detroit 2. Conference open to all interested.)

Nov. 15-17—American Oil Chemists' Society. Fall Meeting, Pennsylvania Hotel, New York. (John B. Calkin, Union Bag & Paper Corp., 233 Broadway, New York 7.)

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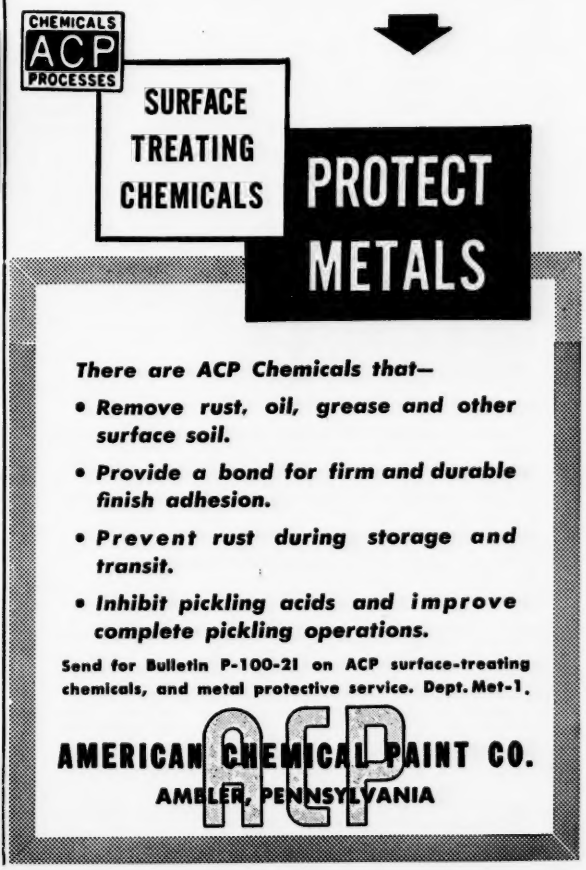
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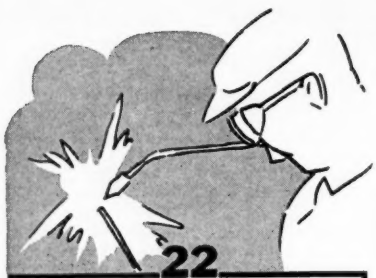


22 JOINING and FLAME CUTTING

22a—General

22a-180. Contact Fillet Welding at High Speeds. (In Russian.) G. V. Nedzvetskii. *Avtogennoe Delo.* (Welding), April 1948, p. 10-12.

New type of machine for the above. Optimum welding conditions for low-carbon steel and brass sheet.

22a-181. Heating and Cooling Curves of Metals During Welding. (In Russian.) L. A. Fridlyand. *Avtogennoe Delo.* (Welding), April 1948, p. 12-16.

Attempts to establish a theoretical relation between the rate of preheating of the weld and its cooling rate. Obtained theoretical data are confirmed by experimental investigation.

22a-182. Brazing, Soldering and Oxy-Acetylene Processes. Robert W. Bennett. *Metals Review,* v. 21, Aug. 1948, p. 3, 5, 7.

Reviews 1947 literature. References to "A.S.M. Review of Current Metal Literature".

22a-183. Welding Supplies and Equipment. *Metals Review,* v. 21, Aug. 1948, p. 9, 11, 13, 15, 17.

New products and techniques developed during the past six months as described by the manufacturers.

22-184. Metallurgical Books. Sibyl E. Warren. *Metals Review,* v. 21, Aug. 1948, p. 41, 43, 45, 47.

Books published during 1936-1946 on welding and cutting, working processes, machining, and surface treatment.

22a-185. Resistance Welding in Mass Production; Control Equipment for Resistance Welders. A. J. Hipperson and T. Watson. *Welding,* v. 16, Aug. 1948, p. 350-354.

Characteristics of different types of resistance-welding control devices and their methods of operation.

22a-186. Electrical Characteristics of the Arc in "Heliarc" Welding. H. T. Herbst. *Welding Journal,* v. 27, Aug. 1948, p. 600-604.

Heliarc welding is different from other methods of arc welding in that the arc is drawn between the workpiece and a virtually nonconsumable tungsten electrode while the electrode, the arc and the weld metal are protected by a sheath of inert gas. The use of an inert gas as a shielding medium makes it unnecessary to use flux when welding most of the common metals.

22a-187. Development of Arc Welded Propeller Hubs. Clarence C. Mast, Paul F. Hackethal and Douglas W. Hamilton. *Welding Journal,* v. 27, Aug. 1948, p. 605-609.

Design and welding steps used.

22a-188. Modern Projection Welding. Robert A. Reich. *Welding Journal,* v. 27, Aug. 1948, p. 610-612.

A method of resistance welding whereby the current flow and heating during the welding operation are localized at predetermined points called projections or embossments.

22a-189. Contact Electrodes and Applications of Contact Arc Welding. P. C. van der Willigen and G. Zoethout. *Welding Journal,* v. 27, Aug. 1948, p. 615-620.

The special characteristics of contact-arc welding are shown as applied to vertical and horizontal welding. Advantages are set forth and a new application, "contact-arc spot welding", is discussed.

22a-190. The Weldability of Alloys for High-Temperature Service. George E. Linnert. *Welding Journal,* v. 27, Aug. 1948, p. 385s-405s.

A new laboratory test specimen which incorporates the design features found in the weld joint of a bucketed gas turbine wheel is employed. Virtually all of the crack-type defects reported to occur in welded bona-fide turbine wheels are reproduced in this "wheel and bucket" test specimen, the most important kind of cracking being a form of notch extension which propagates from the junctions between the buckets and travels transversely across the weld deposit.

22a-191. Welding Arc Temperatures. W. R. Chynoweth, J. U. Jeffries, R. J. LaPante, R. J. Krieger and G. H. Fett. *Welding Journal,* v. 27, Aug. 1948, p. 426s-427s.

Determination of temperature of welding arc under assumed conditions of thermodynamic equilibrium. It is recognized that there is no such thing as equilibrium in the welding arc. Factors which govern arc temperature.

22a-192. Bronzewelding in Repair Work. T. J. Palmer. *Machinery* (London), v. 73, Aug. 5, 1948, p. 162.

Process and application.

22a-193. Rare and Purer. *Industrial and Engineering Chemistry,* v. 40, Sept. 1948, p. 10A, 12A, 16A.

Development of method for production of high-purity helium and its advantages for welding Al, Mg, Ti, Zr, and stainless and high alloy steels by the shielded-arc method.

22a-194. Resistance-Welding Equipment Considerations. C. E. Smith. *Electrical Engineering,* v. 67, Sept. 1948, p. 865. Based on "Resistance-Welding Machine and Power Supply", to be published in *A.I.E.E. Transactions,* v. 67, 1948.

Factors to be considered in selection of the equipment.

22a-195. Code Restrictions on Welding. Walter Samans. *Mechanical Engineering,* v. 70, Sept. 1948, p. 772-773.

The chairman of several committees on pressure-vessel codes defends the codes which J. F. Lincoln of Lincoln Electric Co. believes are "unfair" to welding and overly favorable to riveted construction.

22a-196. How to Choose and Use the Correct Electrode. Part II. Lew Gilbert. *Industry and Welding,* v. 21, Sept. 1948, p. 40-42, 46-47, 87-88.

Welding technique, importance of interpass cleaning and different types of weld defects—their causes and cures.

22a-197. Welding for Economy-Flexibility-Appearance. Power Shovels and Cranes. Lou Hardnack. *Industry and Welding,* v. 21, Sept. 1948, p. 50, 52, 54.

Thew Shovel Co. has gradually redesigned component parts and thus far converted 70 per cent to weldments.

22a-198. Precision Soldering of Small Parts. *Iron Age,* v. 162, Sept. 9, 1948, p. 77.

Process for soldering magnetic pole pieces to a tiny diaphragm disk 0.0038 in. thick in the earpiece of a hearing aid.

22a-199. Production Gas Joining Air Conditioning and Refrigeration Parts. Ward Swarthout. *Steel,* v. 123, Sept. 13, 1948, p. 116, 119, 148.

Closure, jointing, mounting, and other major operations are efficiently accomplished by oxy-acetylene welding and low-temperature brazing.

22a-200. Standardization of Gas Welding Using Acetylene-Oxygen Flames. (In Russian.) I. S. Smirnov. *Avtogennoe Delo* (Welding), May 1948, p. 28-31.

For cast iron, steel, copper, and brass.

22a-201. Standardized Guns Cut Welding Costs. Rex Heath. *Tool Engineer,* v. 21, Sept. 1948, p. 36.

A series of these welding guns developed by Progressive Welder Co., Detroit.

22a-202. Choosing the Correct Metals-Joining Method. Joseph W. Kehoe. *Machinery,* v. 55, Sept. 1948, p. 185-188.

Factors involved in choosing a method that will fulfill requirements.

22a-203. New Electronic R-W Controls. Part I. Fundamental Timers and Non-Synchronous Controls for Resistance Welding. B. Sussman. *Welding Engineer,* v. 33, Sept. 1948, p. 44-48.

Circuit diagrams for the above.

22b—Ferrous

22b-245. Spot Welding of SKhLF Steel. (In Russian.) A. S. Gel'man and S. S. Astaf'ev. *Avtogennoe Delo* (Welding), April 1948, p. 1-10.

Spot welded specimens of above steel (C, 0.12%; Si, 0.31%; Mn, 0.52%; S, 0.030%; P, 0.10%; Cr, 0.55%; Ni, 0.45%; Cu, 0.68%) were investigated and optimum conditions for welding established. Mechanical properties of the specimens.

22b-246. Coating of Steel Electrodes for Welding Cast Iron. (In Russian.) P. S. Elistratov. *Avtogennoe Delo.* (Welding), April 1948, p. 17-19.

Coatings of different compositions for the above. On the basis of obtained data, the optimum composition was established.

22b-247. Mechanical Properties of Joints Made by Gas Pressure Welding During Construction of Main Pipe Lines. (In Russian.) A. S. Fal'kevich. *Avtogennoe Delo.* (Welding), April 1948, p. 20-22.

Conditions for welding low-carbon-steel pipe made of thin longitudinally welded sheets Mechanical properties of welded joints.

22b-248. Production of Milling-Machine Tools by Building Up High-Speed Steel by Use of Arc Welding and Specially Coated Electrodes. (In Russian.) Z. M. Ryzhik. *Avtogennoe Delo.* (Welding), April 1948, p. 22-23.

Methods of production, composition of the coatings, and the heat treatment of the finished tools.

22b-249. Influence of Heat Treatment on the Strength of Spot Welds in "Chromansil" Steel. (In Russian.) F. E. Tret'yakov. *Avtogennoe Delo.* (Welding), April 1948, p. 25-26.

Results of investigation.

22b-250. Welding in Steel Plant Maintenance. T. W. McAuley. *Canadian Metals & Metallurgical Industries,* v. 11, Aug. 1948, p. 19-22, 40-42.

Application of arc welding in design, fabrication, construction, and maintenance at Algoma Steel Corp.

22b-251. High-Purity Helium Saves Money on Aluminum Welds. William A. Mays. *Welding Journal,* v. 27, Aug. 1948, p. 609.

In using welding-grade helium in welding aluminum, it has been found that one-fifth to one-third more helium is normally required

(Turn to page 44)

To Hold Casting Conference

The Purdue Metals Casting Conference scheduled for the Purdue campus in Lafayette, Ind., Nov. 4 and 5, will feature separate technical sessions on the second day of the conference, for the ferrous and nonferrous interest groups. Sponsored by the Purdue departments of general engineering and chemical and metallurgical engineering, with the cooperation of the Technical Extension Division of the university, and the American Foundrymen's Society, the conference will cover subjects of interest to top management, supervisory personnel and any others interested in production and use of castings.

The principal speaker for the ferrous group will be R. G. McElwee, manager, iron foundry, Vanadium Corp. of America. He will be assisted by a panel of specialists. For the nonferrous group, the principal speaker will be Hiram Brown, chief metallurgist, Solar Aircraft Co.

Allis-Chalmers RCA Distributor

Allis-Chalmers Mfg. Co. and the RCA Victor Division of Radio Corp. of America have jointly announced a new arrangement for the distribution of industrial electronic equipment. Under this arrangement Allis-Chalmers will distribute RCA high-frequency heating equipment and RCA metal detectors in addition to its own line of electronic heating equipment. Both companies will continue their research, engineering and manufacturing in the field of electronics.

Fansteel Acquires Full Control Of Vascoloy-Ramet Corp.

The entire common stock equity in Vascoloy-Ramet Corp. held by Vanadium-Alloys Steel Co. has been acquired by Fansteel Metallurgical Corp., North Chicago, Ill.

Vascoloy-Ramet Corp. was established in 1933 to manufacture and distribute tantalum-tungsten carbide cutting tools, dies and wear resisting parts. Two-thirds of the company was formerly owned by Fansteel Metallurgical Corp., who supplies the company with its rare metal materials, and one-third by Vanadium-Alloys Steel Co. Vascoloy-Ramet will continue to be operated under its own name as a division of Fansteel Metallurgical Corp.

CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	Nov.		M. A. Scheil	Metallurgy and Welding
Boston	Nov. 5	Hotel Sheraton	R. L. Kenyon	Finishing Steel for Decorative and Protective Purposes
Buffalo	Nov. 11	Chevrolet-Tonawanda Div., G. M. Corp.		Plant Visitation
Calumet	Nov. 9	Phil Smidt & Son	H. P. Croft	Copper and Copper Alloys
Chicago	Nov. 8	Furniture Club of America	J. O. Almen	Improving the Life of Dynamically Stressed Parts
Cincinnati	Nov. 11	Engineering Society	Chas. W. Briggs	Cast-Weld Construction
Cleveland	Nov. 1	Cleveland Club	Harold Work	Some New Developments in Steelmaking
Columbus	Nov. 12	Southern Hotel	E. U. Condon	Columbus Technical Council Group Meeting
Dayton	Nov. 3	Engineers' Club	Donald B. Gillis	Economic Aspects of Our Iron Resources
Detroit	Nov. 8	Rackham Educational Memorial	A. B. Kinzel	Metallurgical Aspects of Welding
Georgia	Nov. 1		William Bolte	Southern Automotive Industry
Hartford	Nov. 9	The Hedges	S. G. Fletcher and R. P. Kells	The Dimensional Stability of Steel
Kansas City	Nov. 17	Fred Harvey's Pine Room	E. O. Dixon	Forgings
Los Angeles	Nov. 18	Rodger Young Auditorium	S. L. Hoyt	Metallurgy of Welding
Mahoning Valley	Nov. 9	V. F. W. Hall	Erle G. Hill	Openhearth Night
Milwaukee	Nov. 16	City Club	Ralph W. E. Leiter	Deep Drawing of Carbon and Stainless Steel
Montreal	Nov. 1	Queen's Hotel	G. E. Brumbach	Air Hardening Toolsteels
New Haven	Nov. 18	Hotel Barnum, Bridgeport	S. G. Fletcher and R. P. Kells	Causes and Prevention of Common Tool Failures
New Jersey	Nov. 15	Essex House, Newark	Vernon W. Sherman	Induction Hardening
Northwestern Pa.	Nov. 18	Meadville, Pa.	Thomas D. Taylor	Cold Finished Bar Steels and their Application to Industrial Purposes
North West	Nov. 4	American Hoist & Derrick Co., St. Paul	Charles Locke	Foundry Practice
Notre Dame	Nov. 10	Engineering Audit., University of Notre Dame	M. G. Fontana	The Eight Forms of Corrosion and Actual Plant Failures
Ontario	Nov. 5			
Ottawa Valley	Nov. 2	Physical Metallurgy Research Lab., Bureau of Mines	G. E. Brumback	Toolsteels
Pittsburgh	Nov. 11		H. K. Work	Research in Steelmaking
Rochester	Nov. 8	Lower Strong Auditorium		Toolsteel & Tool Design Problems
Rockford	Nov. 17	Faust Hotel	H. P. Croft	Industrial Uses of Copper Alloys
Rocky Mountain	Nov. 19	Oxford Hotel, Denver	E. C. Bain	Research in the Steel Industry
Southern Tier	Nov. 8	Green Lantern Inn, Owego N. Y.	D. A. Nemser	Effect of Structure on Machining Steels
Syracuse	Nov. 3	Onondaga Hotel	C. A. Zapffe	Stainless Steel
Terre Haute	Nov. 1	Indiana State Student Union	H. T. Morton	Manufacture and Use of Ball Bearings
Toledo	Nov. 18	Toledo University	E. E. Thum	Implications of Atomic Energy
Tri-City	Nov. 2	Rock Island Arsenal	John C. McDonald	Use and Fabrication of Magnesium Alloys
Washington	Nov. 8	Garden House, Dodge Hotel	F. L. LaQue	Changing Corrosion Resistance by Additions of Alloying Elements in Small Amounts
Western Ontario	Nov. 19	Prince Edward Hotel, Windsor		
Wichita	Nov. 16	K of C. Hall	N. K. Koebel	Heat Treatment of Metals in Controlled Atmospheres
Worcester	Nov. 10	Worc. Polytechnic Institute	Stephen M. Jablonski	Pressure Welding

than when using argon. By using helium, greater penetration is obtained and much faster welding speeds are possible than with argon so that the over-all cost per inch of weld is quite favorable.

22b-252. Spot Welding of Mild Steel in Production. N. E. Wheeler. *Welding Journal,* v. 27, Aug. 1948, p. 613-614.

Design, control, operator training, machine maintenance and inspection.

22b-253. Residual Stresses in a Butt-Welded Structural I-Beam. W. J. Krefeld and E. C. Ingalls. *Welding Journal,* v. 27, Aug. 1948, p. 417s-420s.

Supplementary measurements of residual stresses induced by the welding operation. The order of magnitude of these stresses is of interest in analyzing causes of premature inelastic action found in testing the as-welded beams under both static and dynamic loads. The behavior suggested the existence of relatively high initial stresses.

22b-254. Welding Screw Shafts to Castings. P. H. Setzler. *Iron Age,* v. 162, Aug. 26, 1948, p. 93-94.

Method of producing a combination hot rolled or forged steel shaft and cast steel head in the form of a thermit welded assembly.

22b-255. Welding Beats the Steel Shortage. Walter J. Brooking. *Welding Engineer,* v. 33, Sept. 1948, p. 34-37.

Flexible welded construction made possible the utilization of war-surplus steel shapes, plates, bars, and billets to build the new LeTourneau plant at Longview, Tex.

22b-256. No More Rivets. *Welding Engineer,* v. 33, Sept. 1948, p. 40-41.

New welding techniques being used in hopper-car fabrication.

22b-257. Erie's Floating Dry Dock. George J. Newhams. *Welding Engineer,* v. 33, Sept. 1948, p. 51.

New 400-ton capacity all-welded dry dock.

22b-258. Penstock Practice. O. R. Carpenter. *Welding Engineer,* v. 33, Sept. 1948, p. 56-60, 62.

Use of welding in fabrication of sections of large-diameter steel penstocks.

22b-259. Silver Soldering Spiral Saws. Alexander Maxwell. *Tool & Die Journal,* v. 14, Sept. 1948, p. 60-61.

Recommended procedures. Users of spiral-tooth bandsaw blades are urged to learn how to "weld" their own, in order to increase saw versatility and to achieve savings by purchase of bulk coils of saw blade.

22b-260. Tips on Stainless Clad. Leonard C. Grimshaw. *Industry and Welding,* v. 21, Sept. 1948, p. 70, 72-73, 85-86.

Suggestions for welding.

22b-261. Experience With the Oxygen Arc Method of Cutting Cast Iron Pipe. Sherman L. Rogers. *Water & Sewage Works,* v. 95, Sept. 1948, p. 308-309.

22b-262. Welding Body Sections at Ford. Dempsey Criteser. *Iron Age,* v. 162, Sept. 9, 1948, p. 88-94.

Many of the body sections are handled and welded automatically. The various welding sequences.

22b-263. Furnace-Brazed Assemblies Replace One-Piece Units. H. M. Webber. *American Machinist,* v. 92, Sept. 9, 1948, p. 92-96.

Use for production of miscellaneous steel parts. Numerous units originally forged, cast, or machined from bar stock are now assembled from less expensive punch-press and screw-machine parts and furnace brazed. Other fabricating methods, such as torch brazing, have in some instances been replaced by electric-furnace brazing.

22b-264. Essential Questions Concerning the Welding of Main Pipe Lines. (In Russian.) A. S. Fal'kevich. *Avtogennoe Delo* (Welding), May 1948, p. 3-5.

Main factors to be considered. Different welding processes were investigated. Most suitable methods and conditions.

22b-265. Argon-Arc Welding of Thin Stainless Steel Sheets. (In Russian.) A. Ya. Brodskii. *Avtogennoe Delo* (Welding), May 1948, p. 6-8.

A new method which because of its high efficiency, absence of the necessity for using fluxes, and high strength and corrosion resistance of the welds, is very suitable for the sheets 1 to 1.5 mm. in thickness.

22b-266. Automatic Welding of Pins to Vertical and Overhead Surfaces. (In Russian.) N. G. Ostapenko. *Avtogennoe Delo* (Welding), May 1948, p. 16-18.

Apparatus and technique.

22b-267. Une technique particuliere d'assemblage bout a bout des tuyauteries de vapeur. (A Special Technique for Joining Steam Pipes by Welding.) H. Berbeaux. *Soudure et Techniques Connexes,* v. 2, May-June 1948, p. 92-97.

Oxyacetylene welding for small-diameter tubes and butt welding for large ones. Optimum conditions, including welding-rod compositions.

22b-268. Evolution de la conception et de l'exécution des ponts et charpentes soudés en Belgique. (Evolution in Design and Construction Methods for Welded Bridges and Structures in Belgium.) H. Louis. *Soudure et Techniques Connexeś,* v. 2, May-June 1948, p. 98-110.

Because of numerous failures of welded structures during the past decade, a great deal of research has been done, resulting in extensive changes in design of structures.

22b-269. The Weldability of High Tensile Alloy Steels, and a New Weld Cracking Test. P. L. J. Leder. *Engineers' Digest,* v. 5, July 1948, p. 246-250.

Previously abstracted from a paper of *The Institution of Mechanical Engineers,* May, 1948, 20 pages. Item 22b-214, 1948.

22b-270. Welded Rail Joints Cut Track Maintenance Costs. *Mechanization,* v. 12, Aug. 1948, p. 116, 119.

Experiences of Gauley Mountain Coal Co.

22b-271. Designing for Welding. J. Mikulak. *Machine Design,* v. 20, Sept. 1948, p. 147-152.

Previously abstracted from *Welding Journal,* v. 27, April 1948, p. 290-298. See item 22b-149, 1948.

22c—Nonferrous

22c-21. Attaching Materials to Die Castings With Adhesives. Fred J. Wehmer. *Die Castings,* v. 6, Sept. 1948, p. 46-49, 70-71.

Recommended procedures for rubber, leather, paper, fabric, metal, and glass.

22d—Light Metals

22d-54. Svareni hliniku a hlinikovych slitin. (Welding of Aluminum and Its Alloys.) Miroslav Brzobohaty. *Hutnické Listy,* v. 3, April-May 1948, p. 126-133.

Various methods, and the mechanical properties resulting from the different methods as applied to the various types of Al alloys.

22d-55. Aluminum Pipe Line. M. R. Rivenburgh. *Welding Engineer,* v. 33, Sept. 1948, p. 42-43, 64-65.

Use of inert-gas arc-welding process in the Arkansas-Louisiana oil fields on an experimental aluminum pipe line.

22d-56. Arc Welding of Aluminum and Its Alloys. (In Russian.) V. I. Romanovskii. *Avtogennoe Delo* (Welding), May 1948, p. 18-20.

Recommended procedures for the above, including comparative data on different electrode coatings.

22d-57. Arc Welding of Aluminium and Its Alloys. (Continued.) A. Schärer, *Light Metals,* v. 11, Aug. 1948, p. 461-470.

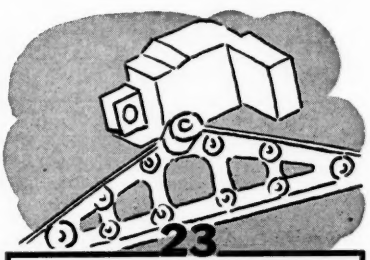
Experiments and results in welding of unalloyed aluminum. Speed of arc welding with that of oxyacetylene welding. Data on mechanical aluminum. (To be continued.)

22d-58. Aluminum Furnace Brazing. P. A. Koerner. *Machine Design,* v. 20, Sept. 1948, p. 128.

Use for fabrication of two aircraft parts. Four advantages over other joining methods for aluminum parts.

For additional annotations indexed in other sections, see:

20b-67; 24a-198; 24b-84-85; 27a-128.



23 APPLICATIONS

23a—General

23a-40. Rigidizing Finds New Applications. *Automotive Industries,* v. 99, Sept. 1, 1948, p. 38.

Several applications of pattern process for design-strengthening ferrous and nonferrous flat-rolled metals.

23a-41. Cutting Tool and Die Materials. (Continued.) *Steel,* v. 123, Aug. 30, 1948, p. 64-66, 68, 70, Sept. 6, 1948, p. 96-100, 102, 104, 106, 109; Sept. 13, 1948, p. 106-110, 112, 114.

This information on cutting tool and die materials lists factors to be considered in the quick selection of toolsteels and carbide types to meet any given requirement. Sources, trade names and applications are conveniently presented. Other pertinent data include chemical analyses, heat treatments, quenching media, movement in hardening and machinability as annealed.

23b—Ferrous

23b-43. Special Steels for the Petroleum Industry. R. Jackson and R. J. Sarjant. *Journal of the Institute of Petroleum,* v. 34, July 1948, p. 445-485.

Effect of composition and methods of fabrication. The causes of corrosion therein encountered and methods of overcoming its effects with special reference to composition. Use of statistical methods of analysis. 28 ref.

23c—Nonferrous

23c-48. The Production of Thin Be Foils. Hugh Bradner. *U. S. Atomic Energy Commission,* AECD-1949, March 18, 1948, 4 pages.

A procedure for making beryllium foils between 10^{-5} and 10^{-3} cm. thick,

(Turn to page 46)

MANUFACTURERS' LITERATURE

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125. Electrodes

New 40-page catalog contains 50 photographs and diagrams, an electrode selector chart and complete details on all electrodes in the Wilson line. Wilson Welder & Metals Co.

126. Finishing

A new manual illustrating and describing roto-finishing in detail with an outline of the four principal procedures—deburring and grinding, polishing, britehoning and coloring. Sturgis Products Co.

127. Forgings

Numbers 1 and 2, Volume 10 of "Forgings" features the farm and petroleum field. Many illustrations and interesting material on forgings for these industries are shown in an attractive manner. Kropp Forge Co.

128. Furnaces, Heat Treating

8-page booklet illustrates gas, oil and electric heat treating and carburizing furnaces. Holcroft and Co.

129. Lab Furnaces

Two new Leco box type furnaces are fully described in a 4-page leaflet; one designed for use in temperatures up to 2900° F. the other for temperatures up to 2600° F. Laboratory Equipment Corp.

130. Magnetic Material

"Hardyne", an easily fabricated permanent magnet material that may be pressed to form complex shapes requiring no sintering discussed in July 15 issue Metal Powder News. Charles Hardy, Inc.

131. Metal Sawing

16-page booklet unique engineering experience embodied in line of four basic circular sawing machines for cutting stock from ¼" to 16½", all utilizing the advantages of the triple-chip saw blade in diameters from 8" to 45", with correct automatic sharpeners to grind all blade sizes. Motch & Merryweather Machinery Co.

132. Nickel Plating

"Practical Nickel Plating" is a new booklet on the subject of industrial nickel plating. It discusses solution compositions and operating conditions, and suggests cycles for treatment of the base metals prior to plating. International Nickel Co.

133. Permanent Magnets

An eight page illustrated bulletin CDM-12 describing GE metallurgical products, including cast and sintered Alnico, Cunife, Cunico, Vectolite, Silmanal, and various permanent magnet holding assemblies. General Electric Co.

134. Plating Rack Coating

4-page leaflet describes "Enthonite 101" a new liquid plastic plating rack coating. Material also has extensive use for coating metals to resist severely corrosive organic materials. Enthone, Inc.

135. Screw Thread Inserts

Bulletin 248 contains 12 pages of latest design data, tables, applications, and illustrations of Heli-Coil screw thread inserts. Heli-Coil Corp.

136. Seam Welders

An 8-page bulletin No. 804 describes new line of roller head seam welders which embody three basic sizes for light, medium, and heavy duty work, also available in three types—for circular, longitudinal welding, or both. Progressive Welder Co.

137. Selenium Rectifiers

8-page catalog describes and illustrates with engineering data a complete line of selenium rectifiers for electro-plating and other industrial uses. Richardson-Allen Corp.

138. Stainless Piping

Bulletin 483, a new 4-page booklet, includes drawings, dimensions and prices of new type fittings and flanges, available in Stainless 304, 347, 316 and other materials. Taylor Forge & Pipe Works.

139. Stainless Steel

8-page bulletin describes a high alloy low carbon austenitic stainless steel known as Durimet 20, for use with about 125 corrosive solutions. Duriron Co., Inc.

140. Tempils

New "Stainless Steel Data Sheet" published in latest Tempil Topic, copies of which will be supplied on request. Tempil Corp.

141. Tube Testing

Testing machine for hydrostatically testing steel tubes or pipes in sizes from 1" to 4" O.D.; lengths from 10' to 26' and at test pressures ranging from 750 psi to 3000 psi described in bulletin. R. D. Wood Co.

142. Welding Electrodes

New electrode booklet DH 45, "Page Hard Surfacing Electrodes," which contains a description of five new electrodes developed to provide a weld metal deposit whose particular properties are suited to definite welding applications. Page Steel & Wire Div.

143. Welding

All metal joining headaches eliminated in a new 8-page illustrated bulletin containing more than 60 illustrations of how new low temperature welding alloys can save defective equipment and machinery. Also featured is the new cutting electrode, Cuttrode, for cutting metals without the use of special equipment or oxygen. Eutectic Welding Alloys Corp.

144. Zinc Alloy

Eraydo Alloy a new high grade zinc alloy is described in a 4-page leaflet, outlining its many advantages and uses in sheet or roll form for home appliances, roofing and a wide variety of products and parts. Illinois Zinc Co.

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and with diameters up to 1½ in., and methods of mounting them.

23c-49. Stellite in the Mining Industry. B. G. MacKenzie. *Canadian Mining Journal*, v. 69, Aug. 1948, p. 71-74.
Development of alloy and application in design and use of tools.

23c-50. Quick on the Trigger. L. E. Parker. *Die Castings*, v. 6, Sept. 1948, p. 27-28, 71-73.
Use of aluminum and zinc die castings in portable hand drill.

23c-51. Die Castings in Special Machines; Automatic Printing Presses. *Die Castings*, v. 6, Sept. 1948, p. 36-38, 59-60.
Various applications of aluminum and zinc die castings to printing presses.

23c-52. Die wirtschaftliche Herstellung von doppelseitig begossenen Stahl-Bleibronze-Lagern. (Commercial Production of Bearings Consisting of Steel With Lead-Bronze Shells Cast on Both the Inside and the Outside Surfaces.) B. Garre. *Archiv fur Metallkunde*, v. 1, Sept. 1947, p. 422-423.

23d—Light Metals

23d-139. Bombole frettate in lega leggera. (Light Alloy Tanks for Compressed Gas.) M. Amico. *Alluminio*, v. 27, March-April 1948, p. 127-142.
Method of production, material used and mechanical properties.

23d-140. Magnesium's Advantages. In What Applications Can They Best Be Used? *Magazine of Magnesium*, Aug. 1948, p. 2-4.
A series of applications for which properties of Mg make it superior to other metals.

23d-141. The Fourteenth Olympiad. *Light Metals*, v. 11, Aug. 1948, p. 441-446.
Use made of light metals in this year's Olympic Games.

23d-142. The Light-Alloy Bicycle in France. Graham Davies. *Light Metals*, v. 11, Aug. 1948, p. 452-459.
A detailed survey of current applications of aluminum to frames, wheels and accessories, with special attention to techniques for joining.

23d-143. Aluminium-Alloy Crane and Bridge. *Engineering*, v. 166, Aug. 6, 1948, p. 127.
Fifteen-ton overhead traveling crane of 97-ft. span recently constructed.

23d-144. The Manufacture and Use of Magnesium and Its Alloys With Special Reference to the Magnesium-Zirconium-Zinc Range. C. J. P. Ball. *Chemistry & Industry*, Aug. 21, 1948, p. 531-536.
Deals especially with the Elektron magnesium alloys (British).

23d-145. Use of Zinc Alloy Die Castings in Waring Blendor. *Machinery* (London), v. 73, Aug. 26, 1948, p. 311-313.

23d-146. They Knew What They Wanted—and Got It. *Die Castings*, v. 6, Sept. 1948, p. 33-34, 61.
Consumer preference was responsible for the change from sand-cast iron to die-cast aluminum for food chopper.

23d-147. The Know-How of Light-Alloy Truck Parts. *SAE Journal*, v. 56, Sept. 1948, p. 27-29. Excerpts from "Design and Operating Experience With Weight-Reducing Materials", by J. L. S. Snead, Jr.
Design principles, including problems involved and cost savings made possible. Typical aluminum parts.

23d-148. Small Lightweight Engine Employs Aluminum Alloy for Principal Parts. *Automotive Industries*, v. 99, Sept. 1, 1948, p. 34, 56.
1½ to 2 hp., single-cylinder, air-cooled, four-cycle engine being placed in volume production.

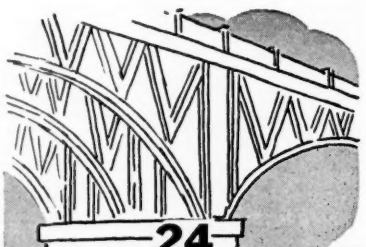
23d-149. Les transports frigorifiques routiers. (Refrigerated Highway Transportation.) Paul Clément. *Revue l'Aluminium*, v. 25, July-Aug. 1948, p. 229-237.
Construction of French refrigerated trucks, in which light alloys are extensively used.

23d-150. L'Aluminium a la 37e Foire de Paris. (Aluminum at the 37th Paris Fair.) Francis Even and others. *Revue l'Aluminium*, v. 25, July-Aug. 1948, p. 243-251.
Applications displayed.

23d-151. Clock Bearing Plates Made From Aluminum. *Machinery*, v. 55, Sept. 1948, p. 206.
Experiments which demonstrated suitability of aluminum for this application.

23d-152. Aluminum as a Structural Material. Paul Weidlinger. *Progressive Architecture*, v. 29, Sept. 1948, p. 77-84.
A technical study. The introduction is followed by sections on characteristics, forming and fabrication, economic aspects, relationships and implications of physical characteristics and economic aspects. (To be continued.)

For additional annotations indexed in other sections, see:
1c-61; 3a-88-89; 3c-65; 27d-14.



24a—General

24a-195. New Principles for the Design of Machine Tool Slides. O. Lich. *Engineers' Digest*, v. 5, July 1948, p. 233-234. Translated and condensed from *Werkstatt und Betrieb*, v. 80, Oct. 1947, p. 265-267.

24a-196. The Measurement of Residual Stresses by Means of Drilling Holes. D. G. Kournossov and M. V. Jakutovich. *Engineers' Digest*, v. 5, July 1948, p. 251-253. Translated and condensed from *Zavodskaya Laboratoria, No.* 11-12, 1946, p. 960-967.
The general case of measuring residual stresses in a plane, when neither the magnitude nor the direction of the main stresses is known. The method is based on the measurement of creep, caused by the loss of equilibrium between residual stresses due to drilling a small hole, and on the calculation of stresses made possible by that measurement.

24a-197. Automotive Designer's Concept of Steel vs. Light Metal. *SAE Journal*, v. 56, Aug. 1948, p. 59-62. Based on "An Automotive Designer's Concept of Steel vs. Light Metals", by D. F. Toot.
Previously abstracted from preprint. See item 24a-143, 1948.

24a-198. Problems of Stress Distribution in Longitudinally Welded Seams. (In Russian.) D. I. Navrotskii. *Avtogennoe Delo* (Welding), May 1948, p. 12-14.
A new theoretical method for its determination. Formulas for calculation and graphical interpretation of the proposed equations.

24a-199. Het Bepalen Van Eigenspanningen. (Determination of Internal Stresses.) W. Soete. *Metalen*, v. 2, July 1948, p. 231-245.
Because of the complexity of the X-ray method for determining internal stresses, some mechanical methods were developed which require exposure of only a small area of "inner surface". Consideration of Mathar's method (small hole plus extensometer) and the American method (strain gages) led to the development of a method combining their advantages but avoiding their drawbacks. 43 ref.

24a-200. Plastic Deformation of a Circular Diaphragm Under Pressure. A. Gleyzal. *Journal of Applied Mechanics*, v. 15. (*Transactions of the American Society of Mechanical Engineers*, v. 70), Sept. 1948, p. 288-296.
A numerical solution of a set of equations consisting essentially of three plasticity laws, two strain-displacement laws, and two equilibrium laws which describe the action of a clamped, thin, circular diaphragm as it yields plastically when pressure is applied to one side. The calculations were applied to results of a tensile test on a specimen of medium steel. 10 ref.

24a-201. Impact Extrusions—Their Design and Production. Herbert Chase. *Machinery*, v. 55, Sept. 1948, p. 168-170.
Factors to be considered in designing impact extrusions, and tolerances recommended.

24a-202. Torsion Bar Springs. Donald Bastow. *Product Engineering*, v. 19, Sept. 1948, p. 111-116.
Basic formulas for stress distribution, energy storage, spring rates, and load capacity. Material selection and heat treatment.

24a-203. Metal Stamping Design for Economy in Production. *Product Engineering*, v. 19, Sept. 1948, p. 122-123.
A series of diagrams which illustrate basic principles.

24a-204. A Simplified Polariscope for Industrial Use. Ray W. Clough. *Product Engineering*, v. 19, Sept. 1948, p. 124-128.
Equipment designed at M.I. T. for application of the photoelastic method of stress analysis.

24b—Ferrous

24b-84. Future Developments in Welded Steel Buildings. Arsham Amirikian. *Welding Journal*, v. 27, Aug. 1948, p. 593-599.
The problems of design with particular reference to welded steel structures. The elements of a new articulated wedge beam framing.

24b-85. Effect of Residual Tension Stress on the Fatigue Strength of Mild Steel. L. D. Hall and Earl R. Parker. *Welding Journal*, v. 27, Aug. 1948, p. 421s-425s.
Static tests of welded structures are made with the object of determining conditions under which residual stresses may contribute to fracture. The large amount of laboratory testing has failed to show that residual welding stresses decrease the static fracture strength of mild steel.

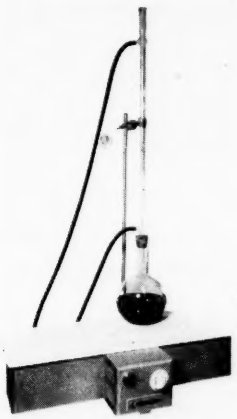
24b-86. Designing Castings in Gray Iron. Charles O. Burgess. *Foundry*, v. 76, Sept. 1948, p. 100-101, 224, 226.
Difficulties experienced and suggestions for overcoming design problems.

(Turn to page 48)

NEW PRODUCTS IN REVIEW

LABORATORY HOT PLATE

The new Lindberg H-5 laboratory hot plate has been designed to aid the laboratory technician in his work of extraction, evaporation, and overnight concentration of analytical samples. This long, narrow plate (5 x 22½ in.) allows the operator to place the flasks and containers side by side, thus giving him an unobstructed view of the action taking place.



The H-5 has a 1300-watt capacity, 115 to 230 volts, 60 cycles. Plate temperatures are accurately controlled with a knob connected to an input controller mounted on the front of the hot plate. Four clamp sockets to accommodate dovetail support clamps are mounted on the rear of the plate.

(715) Use coupon on page 53

LINDBERG ENGINEERING CO.
2444 West Hubbard St.
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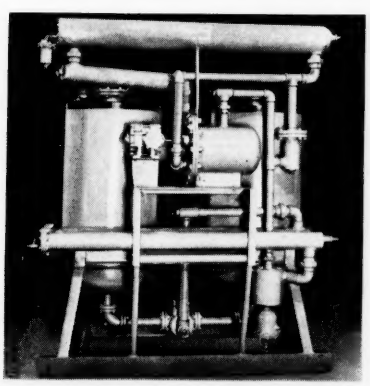
INSTRUMENT AIR DRIERS

For drying instrument air a new line of machines known as BY Lectrodryers is fully automatic. Reactivation, cooling and reversal of the dual adsorber towers takes place without manual attention. The machines require considerably less space than the manually operated dual adsorber Lectrodryers of comparable capacity.



The BY instrument air driers will be built as standard for operation on pressures up to 150 psi., with the purchaser given the option of either steam or electric reactivation. There will be a wide range of standard sizes up to 5000 cu. ft. per min. Larger sizes and higher pressures will be available as special machines. The only moving parts are the reactivating pump and valve reversing mechanism.

Like other Lectrodryer machines, the BY line removes moisture from air and gases by the physical phenomenon known as solid adsorption. Activated alumina is employed as the drying agent.

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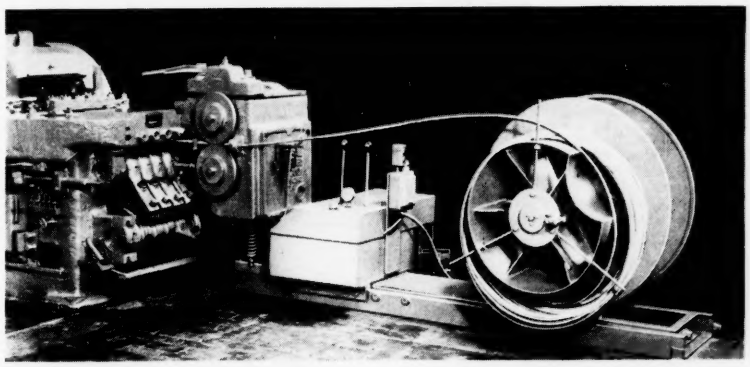

WIRE STRAIGHTENER

Firms operating boltmakers, nut formers and other cold heading equipment using heavy wire, or coiled hot rods, will be interested in a new hydraulic wire straightener.

The device sharply reduces down time when feeding a new coil of wire into a machine, by *(a)* mechanically straightening a length long enough to pass through the feed tube and rolls, and *(b)* supplying power to push the straightened length into the machine. Bending of the wire into a straight length, slipping or sawing off crooked ends, and the manual pushing and tugging usually associated with feeding are all eliminated. A reserve coil may be prepared while the previous coil is still being fed into the heading machine.

The straightener consists of a car which travels on a track frame. The two drums holding the wire coils can revolve on a shaft held stationary in a spindle head mounted on the car. Gripping bars (heavy jaws with V-grooves in them) are mounted on one end of the stationary track frame. Both the car and the bars are hydraulically powered.

The device is operated by placing the butt end of the wire in the gripping bars. The car holding the coil then moves the length of the track, thus straightening a long length of wire. After straightening, the grip bars are released, and when the previous coil has been consumed, the reel head mounted on the spindle is turned 180° bringing the new coil into operating position. The straightened length is then brought into position for feeding. The car is then advanced forcing the wire into the header.

The small model will handle wire up to 3/4 in. in diameter, the medium up to 1-1/4 in., and the large model up to 1-1/2 in.

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NATIONAL MACHINERY CO.
Tiffin, Ohio

BRINELL HARDNESS READER

A direct-reading Brinell hardness number indicator is constructed to fit conveniently into the grip of a

(Turn to page 49)

24b-87. Strength of Large Bolts. Jonathan Jones. *Fasteners,* v. 5, no. 2, 1948, p. 12-13.

On the basis of experiments on 3½-in. threaded rods made for use on a 10-million cu. ft. gas holder, it is shown that on large bolts the effect of Poisson's ratio may, in some cases, be great enough to contract the cross-sectional area a sufficient amount to overload and cause thread failure.

24b-88. Design for Welded Stampings Reduced Cost of Paper Punches. *Product Engineering,* v. 19, Sept. 1948, p. 96.

Paper punches are sold for approximately one third the price of those using castings. Material is cold rolled steel.

24b-89. Nomogram for Designing Steel Torsion Springs. Carl P. Nachod. *Product Engineering,* v. 19, Sept. 1948, p. 167, 169.

24c—Nonferrous

24c-11. Redesign of a Washing Machine Transmission. Leo J. Wubbe. *Die Castings,* v. 6, Sept. 1948, p. 25-26, 66-69.

Permanent-mold transmission housings have given way to die-cast zinc to reduce scrap losses due to excessive porosity, and to eliminate machining operations.

24d—Light Metals

24d-29. Axial Fatigue Tests at Zero Mean Stress of 24 S-T and 75 S-T Aluminum-Alloy Strips With a Central Circular Hole. W. C. Brueggeman and M. Mayer, Jr. *National Advisory Committee for Aeronautics, Technical Note* No. 1611, Aug., 1948, 23 pages.

Tests were made on 0.032 and 0.064-in. 24 S-T and 0.032-in. 75 S-T sheet-metal specimens ¼, ½, 1, and 2 in. wide without a hole and with central holes giving a range of hole diameter to specimen width from 0.01 to 0.95. Evidence was found that a very small hole would not cause any reduction in fatigue strength.

24d-30. How to Design Pressure Moldings. James L. Erickson. *Machine Design,* v. 20, Sept. 1948, p. 118-122, 184, 186.

Combining the desirable characteristics of Al-alloy die castings and heat treated permanent moldings, pressure moldings manifest superior mechanical properties in the as-cast condition and can be heated to elevated temperatures without blistering or distorting. How to design parts to be made by pressure molding from the viewpoint of mechanical properties.

For additional annotations indexed in other sections, see:

22b-253; 27a-121-123.

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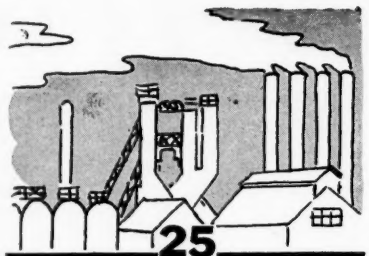


25 STATISTICS

25b—Ferrous

25b-78. Adirondack Iron Ore Mining. D. B. Giles. *Steel,* v. 123, Aug. 30, 1948, p. 72-74, 77.

New York State iron ore mines, among the oldest in the country, are now being looked to as a raw material reserve for the steel industry. These ores are reported to lend themselves to concentration and sintering to produce excellent open-hearth charge ore and blast-furnace sinter.

25b-79. What About the Steel Shortage? Ralph Robey. *Steelways,* Sept. 1948, p. 6-7.

Available supply compared with our war peak. Further expansion.

25c—Nonferrous

25c-61. Uranium. M. S. Krishnan. *Journal of Scientific and Industrial Research,* v. 7, Jan. 1948, p. 30-38.

The principal uranium minerals; their occurrence and origin; effects of radiation; uses of uranium; presence of U and Ra in various materials; mining and technology; distribution in India; production; prices; and prospects. 12 ref.

25c-62. Government Controls Needed Over Copper, Lead and Zinc to Meet Probable Deficits. Charles Sawyer. *Metals,* v. 19, Aug. 1948, p. 7-10.

Shortage, prices, and requirements of industry.

25d—Light Metals

25d-16. Panorama della bauxite in Italia. (Outline of Bauxite Situation in Italy). F. Magri. *Alluminio,* v. 27, March-April 1948, p. 143-149.

An approximate estimation of bauxite ore reserves, particularly of central Italy. Data concerning consumption during 1909-1947. Leucite reserves.

25d-17. Rendezvous—Budapest. Imre Fajda. *Light Metals,* v. 11, Aug. 1948, p. 422-435.

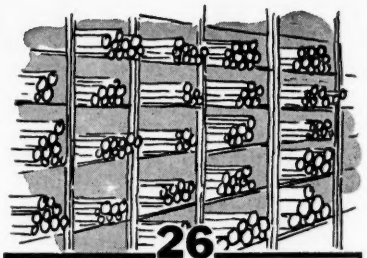
Role of aluminum production and fabrication, at the recent international trade fair held in Budapest. Comments regarding the present technical state of light-metal industries in Hungary.

25d-18. Large Deposit of Titanium Ore Discovered in Eastern Quebec Area. *American Paint Journal,* v. 32, Aug. 30, 1948, p. 20.

Discovery of what may be the world's largest deposit of titanium ore and plans to develop it.

For additional annotations indexed in other sections, see:

27a-120; 27b-38.



26 MISCELLANEOUS

26a—General

26a-74. Progress and Work in 1947. *Brown Boveri Review,* v. 35, Jan.-Feb. 1948, p. 3-71.

Developments of the past year in equipment for production of energy; for transmission, distribution, and conversion of electrical energy; for industry and agriculture (including miscellaneous drive mechanisms, electric kilns, electric welding, compressors and blowers); for electric locomotives; for high-frequency, communications, and remote supervisory-control engineering; and for marine equipment.

26a-75. Research on Bearing Alloys. *Engineer,* v. 186, July 30, 1948, p. 111.

A review.

26a-76. Frictional Properties of Lead-Base and Tin-Base Bearing Alloys: Role of the Matrix and the Hard Particles. D. Tabor. *Engineer,* v. 186, July 30, 1948, p. 117-119.

Experiments carried out on typical tin-base and lead-base bearing alloys. Frictional behavior was investigated at room temperature and at elevated temperatures, in the presence and in the absence of lubricant.

26a-77. Friction Oxidation. Hudson T. Morton and Francis G. Patterson. *Institute Spokesman,* v. 12, Aug. 1948, p. 8-10, 18, 23.

Vibration was sufficient to cause the balls and rollers of the bearings to imbed themselves in the races. Simultaneously with the automotive problems, textile customers reported early failures of bearings subjected to vibratory conditions and oscillating motion of small amplitude. A laboratory research program to duplicate operating conditions and determine the cause of failures is reviewed.

26a-78. Nuclear Energy and Metallurgy. I. Historical Aspects. II. The Nucleus. III. Modern Alchemy. C. Hubert Plant. *Metal Industry,* v. 73, Aug. 13, 1948, p. 123-125; Aug. 20, 1948, p. 146-148; Aug. 27, 1948, p. 163-165, 173.

A review.

26a-79. British Metallurgical Progress. Eric N. Simons. *Machinery Lloyd* (Overseas Edition), v. 20, Aug. 14, 1948, p. 68-72.

Recent developments.

26a-80. Where Will Ultrasonics Fit in the Power Field? Chester R. Earle. *Power Generation,* v. 52, Sept. 1948, p. 86, 88, 132, 134, 136.

Possible applications, including metal testing and soldering.

26a-81. Missive From Moscow. *Industrial and Engineering Chemistry,* v. 40, Sept. 1948, p. 7A, 10A.

Russian work on use of oxygen in miscellaneous chemical and metallurgical processes, on the basis of recent Russian literature.

26a-82. Bearing and Lubricants Center Analyzes Electrical Machinery Prob-

(Turn to page 50)

NEW PRODUCTS IN REVIEW

person's hand. The dial is calibrated to read in Brinell hardness numbers. Two standard dial calibrations are available; one for 10-mm. ball diameter with 3000-kg. load and the other for 10-mm. ball with 500-kg. load. Brinell hardness readers with special dials for the other ball diameters and loads are made to order.

Hardness impressions are made in the usual manner with a Brinell tester. The next step is to press the Brinell hardness reader against the piece under test so that the ball point of the reader enters the impression. The hand of the reader will point to the correct Brinell number without the use of a conversion table.

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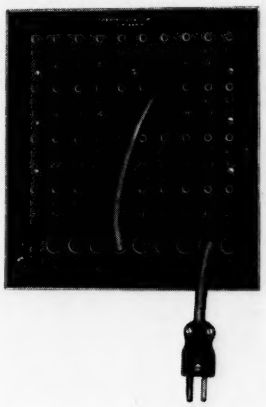

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The panels are designed for flush mounting, and are available in various combinations, with any desired number of jacks and plugs. Polarized plugs and jacks are made of thermocouple materials for all standard calibrations.

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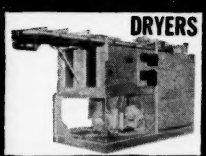

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lems. Donald F. Wilcock. *Steel,* v. 123, Sept. 20, 1948, p. 94-96.

Four general fields of interest are covered including: sleeve bearings and bearing materials, antifriction bearings and their lubricants.

26a-83. New Commercial Tonnage Oxygen System Eliminates Dangerous Hydrocarbons and Resultant Acetylene Explosions. B. H. Van Dyke. *Steel,* v. 123, Sept. 20, 1948, p. 103-104, 134, 136, 140, 143, 146.

Tonnage-oxygen system developed by Elliott Co., Jeannette, Pa., which utilizes an atmospheric-pressure air-distillation system, combined with a nitrogen liquefaction and refrigeration system in such a manner as to provide a unique combination of features and an unusual degree of safety and flexibility in operation.

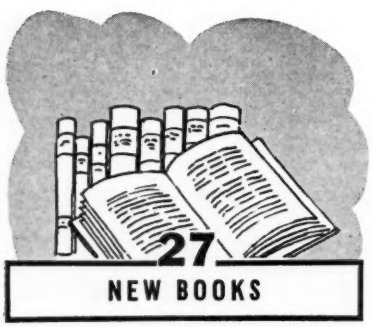
26b—Ferrous

26b-28. Recent Metallurgical Developments. L. Sanderson. *British Steelmaker,* v. 14, Aug. 1948, p. 376-379.

Results of research for improved cleaning and finishing methods together with new developments in analysis, corrosion-resistant processes and a novel means of cutting metal developed in Russia.

For additional annotations indexed in other sections, see:

27a-124.



27a—General

27a-119. Quality Control. Norbert L. Enrick. 122 pages. The Industrial Press, 148 LaFayette St., New York 13, N. Y., $3.

Application of statistical plans to the control of quality in manufacture. 100%-sampling and process-control methods of inspection. Tables for sampling are presented accompanied with instructions for their use. Sample charts for process control and a method for constructing them. Elementary concepts in tolerances and allowances and one on gaging, and the theory of sampling plans and control charts.

27a-120. The History of Basic Metals Price Control in World War II. Robert F. Campbell. 263 pages. 1948. Columbia University Press, Morningside Heights, New York, N. Y. $3.25.

Methods, standards, actions, and results of wartime control of the prices of steel, copper, lead, and zinc.

27a-121. Dimensional Analysis of Engineering Designs. Vol. 1. Components. (Part I.) His Majesty's Stationery Office, York House, Kingsway, London, Eng. $2.35.

Furnishes the product designer with a means of analyzing a design on sound, logical lines to insure that production and inspection are economical in relation to the known functioning requirements. The basic principles required for determination of basic sizes, tolerances, and allowances.

27a-122. Traité de Chimie Analytique Qualitative Minérale. (Textbook of Analytical Qualitative Mineral Chemistry.) Paul E. Wenger, Roger Duckert, and Yvonne Rusconi, 466 pages. 1946. University Publishing House, Georg & Co., Geneva, Switzerland.

Laws governing modern analytical chemistry, theories of acids, bases, ionization, equilibrium of solutions, indicators, hydrolysis. Reactions of cations and anions of all elements. New reagents and methods of application. Preliminary tests and analytical chemical procedures with new approaches in analyses.

27a-123. Mechanics of Machinery. C. W. Ham and E. J. Crane. 538 pages. 1948. McGraw-Hill Book Co., 330 W. 42nd St., New York.

Revised to include important new subjects, and to incorporate changes and improvements that bring the material up to date. Vibrations and critical speeds in shafts, and the gyroscope. Includes additional material on cams and gears, flywheels, and governors, and on balancing, with particular reference to airplane engines. Drafting room problems of a practical engineering nature.

27a-124. Mining Geology. Hugh Exton McKinstry. 680 pages. 1948. Prentice-Hall, Inc., 70 Fifth Avenue, New York, N. Y.

Assembling geological data, geological principles of ore search and ore appraisal, application in specific phases of mining, and technological characteristics of ores.

27a-125. Elasticity and Anelasticity of Metals. Clarence Zener. 170 pages. 1948. The University of Chicago Press, Chicago 37, Ill.

Theoretical interpretation of the various types of anelasticity and the new knowledge which has been obtained through such studies. Various types of anelastic effects and their interrelations. A review is giv en of the various types of relaxations which have been found to give rise to anelasticity. Since the variation of the elastic constants of a metal with microstructure is intimately related to these same relaxation processes, a review and interpretation is also given of the dependence of the elastic properties upon the microstructure.

27a-126. Introduction to Tool Engineering. Halsey F. Owen. 150 pages. Prentice-Hall, 70 Fifth Ave., New York, N. Y. $3.60.

Tool engineering fundamentals, problems of designing for low cost production, manufacturing methods and equipment, methods analysis, manufacturing costs and interchangeable manufacture, operation sheets, tooling programs, tool design, and tool cost estimating.

27a-127. Bibliography on Wire (Manufacture, Treatment, and Properties), Including References to the Cold Drawing of Bars. 146 pages. Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W.I., England.

An extremely careful compilation of the literature on wire drawing. Covers the period up to, and including, 1946, but on the earlier work only the more important references are given. One section deals exclusively with dies and their attendant problems. Numerous references to diamond dies and nonferrous metal wires. (From review in *Industrial Diamond Review,* new series, v. 8, Aug. 1948.)

27a-128. Elementary and Applied Welding. Herbert P. Rigsby and Chris Harold Groneman. 151 pages. Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. $2.00.

Material especially adaptable to the beginning student in both oxy-acetylene and arc welding. Basic procedures. The first third of the book is devoted to fundamental aspects including the equipment required, safety measures to be followed, metals used, and types of welds; the remainder of the book is occupied with projects for construction by the welding student.

27a-129. Report of Tenth Annual Meeting. American Coordinating Committee on Corrosion, 1948, 57 pages.

Minutes of meeting held April 6, 1948 at Hotel Jefferson, St. Louis, Mo.

27b—Ferrous

27b-37. Sintered Iron and Steel Components. C. J. Leadbeater. 61 pages. 1947. Mapleton House, Brooklyn, N. Y. $3.50. (Reproduced from PB46386, Office of Technical Services, Washington, D. C.)

Products and work of five German powder-metallurgy plants. Special topics dealt with include sintered-iron driving bands, bullet cores, and sintered-steel products.

27b-38. 1946 British Iron and Steel Yearbook. 329 pages. 1948. Iron and Steel Institute, London. 15s. ($3.00) plus postage.

For every steel-producing country, statistics on production, imports, and exports; materials consumed in the production of pig iron, steel ingots and steel castings. World tables on production of iron ore from 1929 through 1946, pig iron and ferro-alloys for 1866, 1870 and the period 1875-1946, and steel ingots for the same years. Actual output of steel in all countries, with the exception of Russia, during World War II is also included. Russian production since 1941 is estimated.

27b-39. Fabrication of U.S.S. Stainless and Heat Resisting Steels. 133 pages. 1947. United States Steel Co., Chicago, Ill.

A handbook with thumb-indexed sections on welding, riveting, soldering, joint design, machining, cutting, forming, annealing, and finishing. Actual metal samples showing grades of finish.

27d—Light Metals

27d-14. Aluminum and Aluminum Alloys in the Food Industry. J. M. Bryan. 154 pages. Department of Scientific & Industrial Research, Park House, 24 Rutland Gate, London, S.W.7, England; or His Majesty's Stationery Office, York House, Kingsway, London, W.C.2, England. 3s. 4d.

Comprehensive data on properties of aluminum and its alloys which might conceivably affect their utility in the handling and processing of foods.

27d-15. Casting Alcoa Alloys. 141 pages. 1948. Aluminum Company of America, 2140 Gulf Bldg., Pittsburgh, Pa.

Aluminum ingot products, material choice, casting alloys, foundry practice, foundry principles, and heat treatment.

27d-16. Machining Alcoa Aluminum and Its Alloys. 66 pages. 1948. Aluminum Company of America, 2140 Gulf Bldg., Pittsburgh, Pa.

Desirable characteristics in tools for machining aluminum and its alloys; speeds, feeds, and depths of cuts which will operate these tools satisfactorily; where common practice as well as tools of standard design may be used; and where the use of special practices or tools will produce better results.

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A new 12-ton capacity press is especially designed for high-speed and economical production of powdered metal parts, including porous bearings, alnico, cemented carbides, iron cores, thin-walled bushings, blind end bearings, parts with concentric projections, hemispherical shapes, flanged bearings, high-bronze bushings, as well as ceramic parts and carbon mixtures.

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(*Turn to page* 53)

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933 AND JULY 2, 1946

Of **Metals Review**, published monthly at Cleveland, Ohio, for October 1, 1948, State of Ohio, County of Cuyahoga, ss. Before me a Notary Public in and for the State and county aforesaid personally appeared W. H. Eisenman, who, having been duly sworn according to law, deposes and says that he is the Business Manager of **Metals Review**, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 embodied in section 537, Postal Laws and Regulations, to wit:

1.—That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, Editor, M. R. Hyslop, 7301 Euclid Ave., Cleveland; Managing Editor, M. R. Hyslop, 7301 Euclid Ave., Cleveland, O.; Business Manager, W. H. Eisenman, 7301 Euclid Ave., Cleveland, O.

2.—That the owner is: The American Society for Metals, 7301 Euclid Ave., Cleveland, O., which is an educational institution, the officers being: President, F. B. Foley; Vice-President, H. K. Work; Secretary, W. H. Eisenman; Treasurer, E. L. Spanagel; Trustees: J. E. Dorn, A. E. Focke, E. G. Mahin, C. M. Carmichael, and A. L. Boegehold. All officers as above, 7301 Euclid Ave., Cleveland, Ohio.

3.—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

W. H. Eisenman, Business Manager

Sworn to and subscribed before me this 1st day of October, 1948. (Seal) Genevieve G. Fitzgerald, Notary Public. (My commission expires March 26, 1949.)

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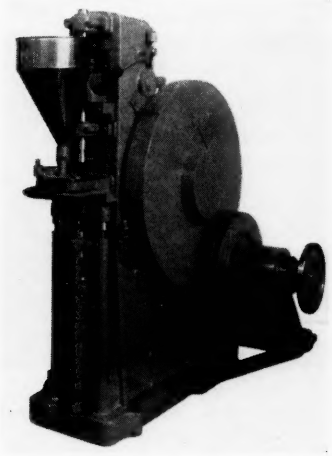

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Check These Numbers for Production Information and Manufacturers' Catalogs. The numbers refer to the new products and bulletins listed in the article on "Steel Plant Equipment" starting on page 11, *as well as to the new products on these pages.*

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Metals Review, October, 1948

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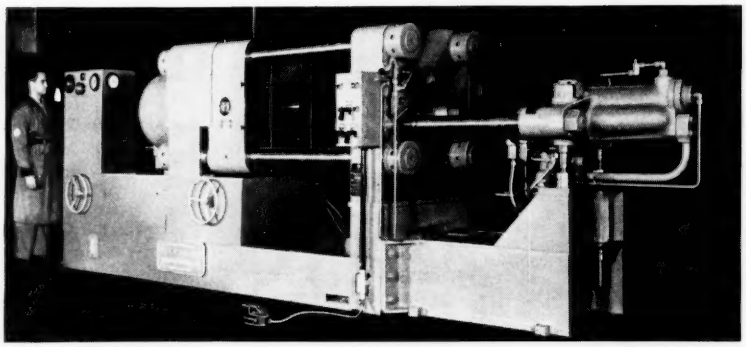

This continuous salt bath heat treating unit (for use with neutral or cyanide salts) is especially suited to hardening of screws, bolts, or other small parts of various shapes. Relatively small lots of different parts, requiring varying cycles for proper hardening, can be handled speedily and economically.

The installation consists of two pot-type furnaces, a quench unit, a wash unit and a drier. All are totally enclosed to protect the operator, and all fumes are carried off by stacks. Automatic handling equipment, controlled manually but hydraulically operated, loads the charge into the salt baths and transfers the work through quench, wash and drier, finally delivering it, clean and dry, into a transfer box.

Charges range from 100 to 125 lb., and salt bath temperature and heating cycle may be varied as necessary. Capacity is 300 to 500 lb. per hr. of finished work when cyanide hardening screws to a case depth of 0.003 in.

The furnaces can be designed to use oil, gas or electricity as fuel. When oil or gas is used, the spent flue gases are used to heat the drier.

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COLD-CHAMBER MACHINE

A large, all-hydraulic, cold-chamber machine is announced for the production of die castings of aluminum, magnesium and copper-base alloys. Aluminum castings weighing up to 10 lb. each can be mass produced with this new machine. Sustained injection pressures are applied through the cold-chamber injection system and these high pressures are confined within the die cavities. This keeps porosity at a minimum.

Certain advantages are incorporated in this new design which were not available in the preceding model. For instance, clearance is provided below the die space mounting to accommodate core pulls attached to the bottom of the die and to permit castings to drop directly onto a conveyor or into a quenching tank.

The vertical position of the injection assembly is adjustable at either the centerline of the machine or 6 in. below center depending on the part and its gating.

Injection speed is doubled from 100 to 200 ft. per min. without the use of additional motors. All electrical controls and timers, with the exception of the operating switch panel, have been moved to the end of the machine, protecting the controls from heat and molten metal.

The hydraulic power unit and its reservoir are mounted integral with the machine base at one end of the machine.

New safety features have been added, and hand wheels are relocated in the front of the machine.

The new H-P-M die-casting machine has a maximum die clamping pressure capacity of 400 tons. Die platens are 38x38 in. Die space is 23x38 in. Clearance between rods is 23x23 in., and daylight opening 42 in. Ram travel is 16 in. with a shut height of 26 in. minimum.

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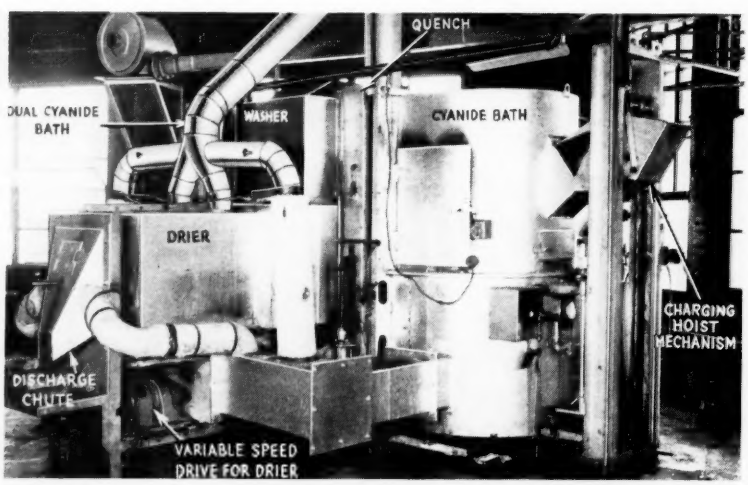

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A sintered carbide alloy, especially designed for high speed planer tools, is available on a commercial basis under the trade name Carmet Grade CA-51. Blanks can be supplied for planers using either the clamped-in or brazed-type blanks.

The following data were compiled from a typical test with a planer using clamped-in blanks:

Material cut—60% semi-steel casting.

Depth of cut—up to 1-1/2 in.

Feed—0.100 in.

Surface speed—175 ft. per min.

Metal removed—as much as 2100 lb. per grind of tool. Most economical metal removal, 1750 lb. per grind. Best previous, approximately 600 lb. per grind using standard carbide alloys.

Other applications for Carmet Grade CA-51 include blanks for heavy turning, boring and facing tools, as well as similar operations where an exceptionally strong carbide is required.

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The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A. S M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

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HEAT TREATING SUPERVISOR: Shop executive for planning and supervision large heat treating plant handling great variety metals and parts, Philadelphia area. Must have thorough technical knowledge of metallurgy and broad practical experience in heat treating. State qualifications fully and starting salary. Box 10-140.

Midwest

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METALLURGIST: B.S. degree from University of California. Six years' experience in steel foundry, openhearth, electric furnace, rolling mill, wire mill, metallography, inspection. Perfect knowledge of technical Russian, can teach and translate. Desires position with college or research institute. Box 10-40.

METALLURGIST: Seventeen years' experience in metallurgical (ferrous and nonferrous) and materials engineering, including development, design, production, and quality control. For past four years, assistant chief metallurgist of aluminum fabricator—deep drawing, painting, anodizing, alodizing, polishing, welding and brazing. Available for position in development engineering, production, quality control, technical advice or sales. Box 10-45.

METALLURGICAL ENGINEER: Under 30, married, in complete charge of induction heating laboratory where he is responsible for all metallurgical recommendations to customers, as well as estimating production rates and suggestions as to design, materials, and handling methods. Experience covers hardening, soldering, brazing, and annealing. Any location. Box 10-50.

METALLURGIST: Eight years in physical metallurgy and shop problem work in casting, drawing and rolling of copper and copper-base alloys—some ferrous experience. Can write reports. B.A. in chemistry, 1940. Prefers New York or New England. Minimum salary, $4800. Box 10-55.

METALLURGICAL - MECHANICAL ENGINEER: Age 26, married. Speaks Spanish. Two years' training at Allis-Chalmers Mfg. Co. working in laboratories. Interested in metallographic laboratory, production of stainless steel, or stainless steel precision casting. Box 10-60.

METALLURGICAL ENGINEER: Age 34. Four years' experience in alloy steels, involving investigation of failures, research and development work. Specialty — metallographic techniques. Handled tool, stainless, valve, and constructional steels, high-temperature alloys, and cast irons. Experience in powder metallurgy research, and four years' teaching experience. Seeks permanent connection. Box 10-65.

METALLURGIST: Age 28, married, B.S. Seven years' experience in ferrous and nonferrous field. Good metallographist. Extensive experience in the application of X-ray diffraction in metallurgical problems. Desires research or development position with good organization. Familiar with all the tools used in metallurgical research. Best references. Box 10-70.

METALLURGICAL ENGINEER: Available to apply experience, energy and supervisory ability. Eleven years' practical experience including research, heat treatment, metallurgical control, material specification work and process development. B.S. degree, married, two children. Present income $7700, age 33. Box 10-75.

METALLURGICAL ENGINEER: B.S. in metallurgical engineering. Age 28, Married. Desires position as metallographer and/or junior metallurgist in production heat treating. Would like permanent position located in western states. Box 10-80.

METALLURGIST: Desires responsible position in development, production, or technical sales. Five years' experience in research and development including radiography, testing, inspection of aircraft materials; melting, casting, heat treatment, testing of temperature resistant alloys. S.B. and S.M. degrees. Age 27, married, one child. Metropolitan New York or New England preferred. Box 10-85.

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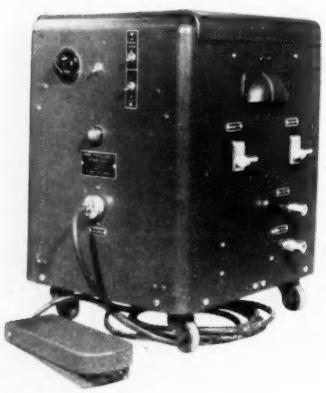

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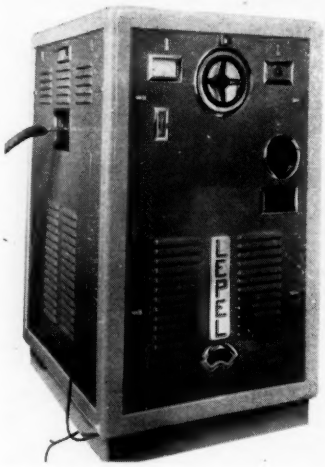

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Published annually since 1944, yearly editions of the ASM Review of Metal Literature are your reference key to all published information from all sources on metals and the metal industry. New 1947 edition with its 8300 abstracts, contains a complete survey of all of the metallurgical literature published during the period, January through December, 1947. The four editions give you a complete four-year record of the industry. Future editions will report literature of succeeding years.

The brief digests of this literature are not intended to serve as a substitute for a reading of the articles listed. They are, rather, brief abstracts designed to indicate the scope and content of the article so that you may determine whether it is something you want to read in its entirety.

The table of contents lists the 27 sub-divisions and classifications of the industry with explanatory notes on each. This classification is arranged primarily by process. There is also a comprehensive subject index giving hundreds of references to metals, processes and equipment. These are indexed in detail with subheads and cross-references to enable the location of articles on any specific subject related to the metal industry.

In using this book, such broad fields as corrosion, foundry practice, or welding may be quickly located in the table of contents. Details on such metals as aluminum alloys, copper, or cast iron may be located in the subject index. Specific aspects of corrosion or welding may be checked in the subject index. An author index is also provided and a list of addresses of the 376 publications that have been reviewed during the year.

Every effort has been made to make this a complete annual review of metal literature so that in consulting it the reader can be assured that he is being referred to *all* of the material published during the year on the specific subject he is studying. All digests were prepared in the library of Battelle Memorial Institute, Columbus, Ohio.

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